RAILROAD GAZETTE

ESTABLISHED IN APRIL, 1856.

PUBLISHED EVERY FRIDAY BY THE RAILROAD GAZETTE AT 83 FULTON STREET, NEW YORK
BRANCH OFFICES AT 375 OLD COLONY BUILDING, CHICAGO, AND QUEEN ANNE'S CHAMBERS, WESTMINSTER, LONDON

EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

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VOL. XLII., NO. 5. FRIDAY, FEBRUARY 1, 1907.

It would seem to a listener, last week at the American Institute of Electrical Engineers, to the interesting paper, "The Electrification of Steam Railways," and the discussion on the paper, which is printed in this issue, that the days of the steam locomotive are quickly to be numbered. During this one evening the discussion centered solely on the comparative amount of economy and good service to be got by electric traction, not alone in special cases where conditions require the elimination of products of combusion, or where additional economies can be had by the elimination of any type of locomotive and the use of motor cars. It seemed to be assumed that the substitution of electric for steam power on all railroads is economical. The authors and speakers went far beyond calculations for specific installations and entered the comprehensive field of the entire railroad mileage of the United States, from which they drew staggering totals. It seemed to be apparent that if the railroads would only make haste to get 2½ billions of new capital they could save 250 millions each year in operating expenses. We have before quoted the statement at the International Railway Congress made by Mr. Aspinall, of the Lancashire & Yorkshire Railway in England, to the effect that he did not electrify his Liverpool & Southport line for the purpose of saving money, but that it was in the hope of making money—at a high traction cost. His statement has been confirmed in his own experience and by many other experiences. Moreover, 2½ billion dollars is something like 30 years' world production of gold at the present rate of output. It is well to remember also that the rough estimate of the capital requirements of the railroads of the United States for the next five years is something like a billion dollars a year, in order to provide track, yards, cars, signals and the other necessary appliances for making transportation keep pace with the growing industries. It is not intended in calling attention to these costs to in any way dampen the enthusiasm of electrical engineers; it is rather to suggest that they continue to go ahead as they have done so rapidly during the past 10 years in finding the safest and most reliable methods of using electricity for heavy traction without diverting their attention to the larger problems which require a knowledge of a different set of facts. It has been said before this that the person who has observed but a few facts can make up his mind with great definiteness. A child who pressed her nose against the window pane reported her observations and deductions as follows: "The ash man is coming; he has stopped in front of our house; he has picked up something from the gutter; O! mamma, he has thrown in the ash heap a perfectly good cat!"

A reduction from $1,000 to $250 a month in the cost of belt maintenance for a single large railroad shop plant, and of over 80 per cent. in the monthly average number of belt failures, is a noteworthy achievement in shop betterment; for besides the saving on the belting, which alone is a substantial annual item, the improved operating efficiency due to better belt conditions, and the cutting down of time lost by machines from belt failures, means an additional and much greater saving, which reduced to dollars would make a most respectable sum. The figures given last week represent an actual performance—the shops being those of the Atchison, Topeka & Santa Fe at Topeka—and the figure for the present monthly maintenance cost represents not an isolated month's performance but the average for 12 months. Of course, the practice prior to the application of the improved methods was admittedly bad and extravagant, though probably representative of the practice obtaining in the average similar plant throughout the country. Ignorance or disregard of right principles—comparatively few and simple though they be—was characteristic of the belting installations and maintenance in far too many such shops, and still is to a much greater extent than it should be, though modern methods recognize the importance of maximum efficiency in this regard. In view of the excellent results obtained at Topeka, and believing a detailed presentation of the methods in vogue there would be of interest and value to all who have to do with belting in any capacity, we printed in our issue of Jan. 25 a copy of the rigid specifications covering the supply of this material to the Santa Fe, and the rules and instructions issued to repairmen for its installation and maintenance. As mentioned in the articles published several weeks ago describing the Santa Fe shop betterment work, the results obtained in revising the belting system and methods at the Topeka shops were secured by the use of the best quality of material only, and by entrusting its installation and maintenance during the transition period to a specialist whose primary object was to *prevent* failures, not remedy them. The cost

of maintaining belts, including material, labor and supplies, should average yearly about 14 per cent. of the first cost, as illustrated by the diagram published in the articles above referred to. This figure has just about been attained at Topeka, furnishing practical proof of the high efficiency of the methods there used.

American railroads in the various States of the Union have been the objects of about every kind of taxation known to civilized man. There has been local taxation and state taxation, taxation of stock, of bonds, of revenue, gross and net, mixed taxation, with some forms of railroad property under local purview, and others under state purview. In some states the municipality or other taxing district collects the tax directly, in other states the state itself collects either for the state treasury or for local redistribution. Amid all these multiplied and hybrid forms of impost, legislation by a number of states to shift the burden of taxation to the railroads has led to the strong impression that general railroad taxation has increased. But the recent comparative returns of all the railroad corporations of the country for the fiscal year ended June 30, 1905, show no such increase. As compared with 1904, mileage in single track rose from 293,937 to 301,331; capital stock from $6,447,045,374 to $6,741,956,825; bonded debt from $7,462,091,455 to $7,821,243,106; gross earnings from $1,977,638,713 to $2,112,197,770, and net earnings from operation from $639,240,027 to $685,464,488; yet taxes remained almost stationary at $54,325,856 in 1904, as compared with $54,553,620 in 1905. It is even more expressive if we compare this practical equation of taxes with a rise of railroad dividends on stock from $188,386,093 in 1904 to $193,753,869 in 1905, or nearly 4 per cent. But a showing, which seems on the face of the returns anomalous, is much less so when analyzed and qualified. The figures go back to actual periods of assessment two and three years ago, and recede to a time antedating considerably the later legislation taxing railroads more heavily. Undoubtedly, also, the railroads in some commonwealths during the periods referred to profited by the general prosperity which, especially with the decrease or extinction of state debts, has lowered the state tax rate. Obviously the time for real comparison will be the two years hence when the railroad taxation of 1907 can be compared with 1906 or earlier. We shall then obtain some instructive figures throwing sidelights not only on the size and results of the new railroad taxation movement, but also on the relative values, civic, economic and corporate, of the various systems, for example, the "realty tax" scheme on the one hand and stock and debt or earning power plans on the other. As now, so then, it will be difficult, if not impossible, to go much into local details of the tangled systems and methods of the many states which have given us the striking tax equation of 1904 and 1905. But we have little doubt that results will indicate that the general scheme of taxing stock on a sliding scale of market values and of taxing debt, including bonds, on more fixed valuations at or near par, will prove to be, on the whole, the system most practical and fair.

SHORT-TERM NOTES AGAIN.

These are hard times for railroads which need money; and this, it appears, is only another way of saying for all railroads. We are experiencing the disadvantages of prosperity. There is so much traffic that the railroads, most of them, cannot anywhere nearly carry it, and even where they are managing to handle it with reasonable satisfaction at present, a new and higher normal level of traffic has been established for which they must provide by increased facilities of every sort—not only cars and locomotives but, as Mr. Hill reiterates, side tracks and terminal facilities. More than this, railroads have been expanding their influence, and consequently their capital needs in other directions during these recent prosperous years. The New York, New Haven & Hartford, for instance, now controls with unimportant exceptions the whole trolley systems of Connecticut and Rhode Island and indirectly a number of valuable electric properties in Massachusetts. The Michigan Central, which is beginning work on the long deferred tunnel under the Detroit river, is another example. New capital is imperatively demanded, but at present, just when the demand is keenest, the possibilities of raising capital in the usual way—by bond issues—are worse than almost ever before. Issues of bonds already outstanding are a drug on the market, and it is out of the question to think of issuing new long-term bonds at the high rates now prevailing which would have to be paid during their life. Railroad companies like those in the Northwest, whose stock sells at a premium, four of which have recently arranged to raise new capital by issues to stockholders at par, have a way open before them, unsatisfactory as it may be under present conditions, since it both seriously lowers the market price of the securities and brings down condemnation from overzealous state officers. The New York, New Haven & Hartford also plans to raise funds in this way, we understand, by an issue of new stock some time in the spring at 150 to holders of its shares and convertible bonds, but it is also adopting another method to meet immediate needs. Within the past month this company has issued $26,000,000 five-year, 5 per cent. notes, which have met a ready sale.

The advantage of financing by notes rather than by bonds under present conditions is clear. Although the road pays well over 5 per cent. for its funds, the charge is not a long-term one. Unless the bond market shows no improvement during the next five years, it will be possible to refund these notes at a lower rate. Other companies are also adopting this way around pressing money needs in an unresponsive market. The Boston & Maine has sold $3,000,000 short-term notes and the Chicago & Alton has made an issue of $6,000,000, most of which, it is worth noting, are to refund similar short-term notes, thus showing that the company has been disappointed in the fact that there is not yet a better market for bonds. A month ago the Erie sold the last $1,000,000 of an issue of $7,000,000 six months 6 per cent. notes. The Chicago & Western Indiana has issued $5,000,000 notes, for which it pays nearly 7 per cent., and the Southern Railway, which last year drew up a $200,000,000 development and general mortgage, securing 5 per cent. bonds, has been compelled, instead of selling these bonds, to make an issue of $15,000,000 5 per cent. notes, which were sold at such a price that the money costs this company also nearly 7 per cent. Largest of all the note issues was the sale announced last Saturday of $50,000,000 5 per cent. three-year notes by three of the New York Central Lines—$25,000,000 by the New York Central, $15,000,000 by the Lake Shore and $10,000,000 by the Michigan Central.

Issuing short-term notes in a bad bond market is not a new device. It was much used in 1903 to tide over the necessities of a period when bonds could not be sold, and was at that time in the main successful. In 1904 and 1905 it was possible to refund the notes with long-term bonds sold at an advantageous price. As things stand to-day the railroads are for the moment in a tight place. Their need for money is as much greater than in 1903 as the traffic of the last two years is than the traffic of 1902 and 1903. Now, too, the railroads are being attacked right and left for failure to properly perform their duties to the public. In order to give the service which is demanded they must have new funds; the necessities of expansion caused by the tremendous growth of traffic cannot be met out of earnings. But those who could supply these funds are frightened away by this very clamor of attack against the roads. Thus the same facts which make it necessary for the railroads to secure funds make it next to impossible for them to do so. There is no doubt but that this condition of affairs is partly the railroads' own fault. The present hostility to corporations has not come upon us by chance or without just causes of complaint behind it. There has been injustice and, more important than that in causing dissatisfaction, misunderstanding, which the railroads have in general not taken the trouble to clear up. As the case stands to-day frank statements by those in authority, like that of Mr. Finley published last week, of the needs of the roads and the reasons for these needs, are necessary to bring the public into the market for railroad stocks and bonds.

COMPARATIVE USE OF WORKING STATISTICS IN TWO COUNTRIES.

To compare the respective use made of actual working statistics (not public statistics) in Great Britain and America, there is presented in this issue an incomplete but, we believe, sufficiently indicative description of the methods in use on one important British railroad and one important American railroad.

In comparing these two it will probably occur to the reader, as it does to us, that on a skilfully managed road, the average length of haul, which is about six times as long in America as it is in Great Britain, is not a condition to be so seriously considered as is commonly believed. The terminal cost is the constant and the length of haul is the variable. The terminal cost can be watched, and to some extent reduced, both by observation and by statistics, as is clearly shown by the article on British railroads. On the other

hand, the variable cost of hauling is directly in proportion to the mileage, and, as appears from both the English and American descriptions, statistics only can give the operating officer the information he wants.

There is one generally prevailing difference in condition between British and American working, and this is that in America an overwhelming proportion of the smaller parcels is carried by express companies, which contract with the railroad companies for haulage on cars adapted for the purpose attached to passenger trains, while in England a comparatively small porportion of this traffic is carried in the passenger vans. The result is that American merchandise freight trains move at a slower and an economic speed, while British goods trains move at something like passenger train speed. Perishable freight, fish, fruits and the like, are moved swiftly in England and moved comparatively slowly in America. The slower movement is made possible by the use of refrigerator cars. The swift movement of goods trains in England seems to be due primarily to the fact that dealers do not keep large stocks of goods on hand, and rely on the use of letters or telegrams, with the result of having their needs met by a fulfilment of their orders early the following morning. This custom has the result that the British railroad company practically furnishes capital to the provincial manufacturer and dealer (on which the manufacturer pays interest in the form of high rates), for the handling of small parcels and conveyance at high speed enormously increases the cost of transportation. There is one other reason for this costly high speed of goods trains. The density of traffic on most British lines is such that in order to do their work the trains must not occupy the line any longer than is necessary. The cost of hauling passenger trains in England and in America is quite alike, while the enormously increased comparative cost of high-speed freight in England consists largely of a contribution to the capital of the trader and the manufacturer.

The reading of the two articles referred to is suggestive in several other respects. It is shown that at least on this one British railroad, the daily statistical returns of car loading and train loading aim to secure, and do secure, quite as quickly and as efficiently as in America, the information needed in order to secure full loading and to prevent the waste of movement by special trains; but we note this difference, that the British divisional officer is limited in his train loading by the power of an engine furnished to him by an entirely independent department. Neither the district superintendent, nor the general superintendent, nor the goods manager may ask for and get, except within narrow limits, the kind of engine which he knows, from his own study of the art of making money by selling transportation, will be most efficient or economical for that purpose. On the other hand, the American operating officers are the ones who decide, not on the design of the engine, but upon its capacity; that can ask for and get engines of prescribed drawbar pull, or of certain maintained speeds hauling certain loads, and the superintendent of motive power furnishes this in his own way. That is to say, he is bound to furnish to that department of the road which earns money a machine capable of doing what it wants. This statement is only partially true. It is the result of the divisional organization, and also of a mixture of departmental and divisional organizations, which obtains quite generally among the best managed American roads, as against a characteristically departmental organization in Great Britain.

It is apparent that the cartage and delivery system adds much to the work of the division officer, but it has distinct advantages. Having control of the whole movement, from the shipper to the receiver, the carting to the receiving platforms can be made much more uniform and, due to this, the goods can be handled at the receiving stations with economy. The idle time of the laborers on the platform is reduced by as much as this receipt of goods is uniform. At the receiving stations the company can make deliveries with like uniformity and avoid congestion such as frequently occurs in American freight stations. This is a subject which is now being studied rather carefully here by a few companies, with a view to its adoption.

On the other hand, the company carting and receiving system is said to have a distinct disadvantage. When manufacturers and traders did their own carting they sent their carts to the station as fully loaded as possible, the inducement being economy in carting. When the company's carts call for goods, the manufacturer or trader delivers his parcels as fast as they are ready for shipment and necessarily in smaller lots. His inducement is to get them out of his way as fast as possible. This is said to tend toward lower wagon loading, at least it makes full wagon loading somewhat more difficult and often increases the number of entries in an invoice, and to some extent separates into different wagons consignments to the same station, for in the hurry of handling goods on the platform, and in the undertaking to secure full loading, full loads to each destination become difficult.

In the northern United States and in Canada the climatic conditions are entirely different from those in Great Britain, where changes in temperature are comparatively slight, and, moreover, the methods of drainage have been brought to such a state of perfection as to be the cause of admiration by all visiting engineers. On the other hand, fogs, with their dangers, delays and costs, are rare in America and common in Great Britain.

Another physical limiting condition which has an important bearing on the use of heavier engines and larger capacity cars in Great Britain, is the limits due to the loading gage. It is not, however, believable that engine power and wagon capacity have yet been developed up to the point where the loading gage interferes and prevents increase.

Another variant in the condition is due to the relative proportion of revenue derived from freight trains and from passenger trains. In America the passenger revenue is comparatively small. We know of no road of any importance whose passenger revenue equals its freight revenue. This varies, too, largely on English roads. For example, on the London & South-Western only about one-fourth of the revenue is from freight, while on the North-Eastern it is nearly equally divided between goods, minerals and passengers.

The length of haul has already been referred to. Considered by itself this should not be a reason why larger vehicles with larger loads and greater power, together with a shortening of the length of trains, should not be proportionately as profitable on the short haul as on the long haul. But the case cannot be entirely considered by itself. Less than car load lots to one destination are more costly to handle than full car load lots to one destination. So that large cars may prove to be economical only partially in goods traffic, with an increasing economy in mineral traffic, as fast as the receivers can be either coaxed or compelled to provide storage for larger quantities.

The customs and prejudices of the people who travel have to be recognized as a fact to be dealt with, and this to a considerable extent prevents the economic handling of other than third class passengers.

It would seem from this brief review of some of the more salient differences in conditions that a daily, accurate knowledge by the division officer, involving statistical reports, such as have been described in the two articles in this issue, is quite as applicable and quite as necessary for economic working in the one country as it is in the other. The basis of economy in freight transportation is in full wagon loading, and the use of wagons of as large capacity as is adaptable to the business. As the wagon has larger capacity, the train with the same tonnage becomes shorter, and is moved with less power.

Yard work, the receiving, breaking up and marshalling of trains is notoriously a widely differing cost, not only in the yards of one railroad as compared with another, but also in different yards on the same road. A competent and economical yardmaster is indeed a great man. Among the forms described as being in use on this one British road, the most novel and perhaps the most profitable one is that which shows the number of wagons handled, the number of hours occupied by engines and horses, and the average number of minutes per wagon occupied in shunting by engines, horses and different kinds of employees. We know of no statistical return, either in England or in America, comparable with this one for securing economy in that part of the work where so much money is wasted.

To one who has had the opportunity to examine and study the daily, weekly and monthly statistical returns described in these two articles, it appears to be true that under widely varying conditions the two methods are not far apart in effectiveness in giving information for preventing waste and securing economy and reliability. Nevertheless, we should be inclined to criticise the British statistical forms as being too bulky, that is, there are many forms where, for the insertion of from four to six figures, nearly a square inch is allowed. A condensed return has somewhat the effect of a graphical diagram. It is handy and its meanings can be grasped at once. A comparison of the British and American blank forms shows a distinct difference in this respect. On one set of blank

forms (the round cornered cards referred to in the American description) condensation, small spaces and printing on both sides have great value, for, as one division superintendent in America expressed it, "it enables him to carry everything in his pocket that he does not have in his head."

December Accidents.

The condensed record of the principal train accidents which occurred in the United States in the month of December, printed in another column, contains accounts of 35 collisions and 17 derailments. Those which were most serious, or which are of special interest by reason of their causes or attending circumstances, occurred as follows:

	Place.	December	Killed.	Injured.
1.	Vergennes, Vt.	1st	3	30
2.	Frankfort, Ind.	5th	0	47
3.	Annabessacook, Me.	6th	4	3
4.	Danville, Va.	8th	1	4
5.	Batesville, Ark.	11th	0	15
6.	Canton, Ohio.	16th	0	2
7.	Palmyra, N. Y.	17th	0	1
8.	Stonington, Ill.	20th	0	25
9.	Harney, Nev.	22d	0	20
10.	Enderlin, N. Dak.	23d	11	33
11.	Detroit, Minn.	28th	5	0
12.	Terra Cotta, D. C.	30th	43	67

The collision at Vergennes, Vt., on the first is notable as being like the Eddington (Pa.) and Sudbury (Ont.) cases in November—air-brake cock closed. Do such cases multiply by "suggestion"? Or have we had them all along and concealed their true nature? The collision at Danville, Va., on the 8th was made notable by the fact that it occurred near the place where President Samuel Spencer was killed, and served as a reminder to some people that faulty working of the block system is not so infrequent as might appear. The collision at Enderlin, N. Dak., appears to be notable mainly by reason of the number of victims, the cause—so far as can be judged by the particulars given—being commonplace. The Terra Cotta collision has already been reported in previous issues, but it is being investigated by the Interstate Commerce Commission, and will, no doubt, be the subject of a report by that body. Some of the testimony taken at the hearing by the commission was published in the *Railroad Gazette* of January 11.

The number of electric car accidents reported in the newspapers of the United States in the month of December was 12, the number of persons killed was eight, and injured 103.

The butting collision at Woodville, Ind., in November, reported in our summary for that month, is declared by the officers of the road to have been due to the negligence of the engineman of westbound passenger train No. 47, first section. This engineman either did not sound his whistle to indicate to the train on the side track that there was a second section, or he sounded it and got no response. In either case he was culpable, for if no response was heard he should have stopped and given notice to the train on the side track by word of mouth.

Substitution of the Electric Motor for the Steam Locomotive.*

The purpose of the paper is fourfold: 1, to record certain facts relative to heavy electric traction which have been established by experience; 2, to present calculations of relative costs of steam and electric traction in railroad service, based upon these facts; 3, to point out the importance of standardizing electric railroad traction equipment as rapidly as may be consistent with progress, and 4, to raise the question whether a frequency of 25 cycles per second or 15 cycles per second should be adopted for the operation of alternating current railway motors.

The first part of the paper is a fairly complete summary of the arguments in favor of electric traction, little of which is new. The third and fourth sections deal with subjects of little more than academic interest to operating railroad officers at the present time and will not be touched on in this brief summary of the paper. The most valuable and interesting discussion is that dealing with the estimate of the comparative costs of operation with steam and electricity.

The authors adopted the grand average results obtained in operation by steam locomotives upon the existing railroads of the United States, as set forth in the report of Statistics of Railroads for 1904 compiled by the Interstate Commerce Commission, and proof-sheets of the report of the Commission for the year 1905. The classification of operating expenses adopted by the Commission and generally used by the railroad companies in their annual reports is followed and the itemized operating expenses in the case of operation by electricity are compared with corresponding expenses under existing conditions of steam motive power equipment. The estimates are based upon the assumption that single-phase alternating current equipment is used; that the trolley potential is 11,000 volts; that each power-house supplies railroad line to a distance of 150 miles in each direction, the feeder potential employed being 60,000 volts; that the overhead construction is first-class in every respect, and steel bridges and field poles set in concrete being exclusively used for the support of both trolley conductors and feeders.

Maintenance of Way and Structures.

Under the general heading, "Maintenance of Way and Structures" item, "repairs of roadway," if changed at all should show some reduction under conditions of electric operation, but no material change is to be expected. We assume, therefore, that this item, amounting to 10.818 per cent. of total operating expenses, will remain unchanged.

The items, "renewals of rails," "renewals of ties" and "repairs and renewals of bridges and culverts," may be conveniently grouped. In the aggregate, these on the average steam operated railroad amount to 6.33 per cent. of the total cost of operation. If the electric locomotive be substituted for the steam locomotive, it is safe to predict that this group of items of expense will be reduced. They would probably be reduced about one-fourth; in other words, they should approximate 5 per cent. of the total operating expenses. The cost of track maintenance is increased by reason of the electric bonding of the rails. This bonding, including the cost of special bonds necessary where an automatic track signal system is used, will cost about $500 per mile under average conditions. Its cost of inspection and maintenance should not exceed $50 per mile of single track per annum. The annual cost of "renewals of rails," "renewals of ties" and "repairs and renewals of bridges and culverts" averages in the United States $400 per mile of track, which is 6.633 per cent. of average operating expenses under steam operation, and for equal trains, as we have estimated, 5 per cent. for electric operation. The effect of the cost of track-bonding, therefore, would increase the items under consideration by about one-eighth, which is equivalent to an increase of 0.8 per cent. in operating expenses.

Item "repairs and renewals of fences, road crossings, signs and cattle-guards" will not be changed by the adoption of electricity.

Item "repairs and renewals of buildings and fixtures" includes repairs and renewals of engine-houses and shops, also water-tanks and coal-handling apparatus. Under electric operation it is evident that this item would be materially reduced from 2.366 per cent. to about 1.3 per cent. of the total annual operating expenses.

Item "repairs and renewals of docks and wharves" obviously will not be affected.

Item "repairs and renewals of telegraph." It is probable that this item will be somewhat increased in general where electric operation is adopted. The effect upon the operating expenses, however, is so slight as to be practically negligible.

Item "stationery and printing" will not be changed.

Item "other expenses" will not be affected.

Under the general heading "Maintenance of Way Structures" the classified statement of operating expenses of a railroad electrically equipped includes the following items in addition to the foregoing:

a. "Repairs and renewals of track bonding."

This has been referred to and is included in the tabulated statement as a separate item, amounting to 0.8 per cent. of operating expenses.

b. "Repairs and renewals of overhead or third-rail construction."

From detailed calculations of the cost of high-class overhead construction, where two tracks are to be equipped, the cost of overhead construction is, approximately, $10,300 per mile. For single-track work, using steel poles and brackets and catenary support, the cost closely approximates $4,800 a mile. Of the total line mileage of the United States in 1905, amounting to 216,974 miles, approximately 0.4 are in double track, including yards and sidings for single track lines, and 0.6 are single track. The grand average cost of overhead steel construction of the type considered, therefore, closely approximates $5,000 per mile of track. The amount which should be allowed for "repairs and renewals of overhead construction" should not exceed $150 per mile of track per annum. This is equivalent to $210 per mile of line per annum, the average ratio of track mileage to line mileage being 1.4 to 1. The increase in operating expenses due to this item is about 3.25 per cent., the average operating expenses per line mile in the United States for the year 1905 being $6,451.

Maintenance of Equipment.

Item "cost of superintendence" will not be changed.

Item "repairs and renewals of locomotives" amounts to 7.509 per cent. of the average operating expenses of our steam railroads. This item does not include the expense of cleaning boiler tubes and packing cylinders, nor ordinary regular inspection, this being charged to the item "engine and roundhouse men." It does include all expenditures for account of repairs and renewals and rebuilding of locomotives, tenders, snow-plows (when attached to locomotives), furniture and loose and movable tools and supplies used in connec-

*Extracts from a paper by L. B. Stillwell and H. St. C. Putnam read at the January meeting of the American Institute of Electrical Engineers.

tion therewith. It also includes the cost of locomotives, tenders and appurtenances thereunto belonging, built or purchased to make good the original number charged to construction or equipment.

As regards repairs and renewals of electric locomotives, actual experience to date is not sufficient to justify us in fixing a figure for this item which can be regarded as established. There is, however, evidence sufficient to justify an estimate which in the average case should be approximately correct.

The reports of the Interstate Commerce Commission do not show what proportion of the item "repairs and renewal of locomotives" is chargeable to renewals, but from inspection of detailed reports of our most important railway systems it seems fair to assume that in the case of the average railway from 4 to 5 per cent. of the total cost of repairs and renewals of locomotives represents the cost of renewals.

Taking into account all of the various considerations which must affect the conclusions in the general case, so far as we have been able to gather them, we are of the opinion that for equal drawbar pull, the repairs and renewals of electric equipment of locomotives, assuming good design and construction according to present standards of the art, should not exceed 1 cent per locomotive mile, and will probably approximate 0.9 cent per locomotive mile.

Taking the higher figure, it is evident that the substitution of electric equipment for all parts of a steam locomotive other than frame, wheels, axles, cab and other parts which are common both to electric and steam locomotive construction, a very great saving is effected. We have been unable to fix with satisfactory exactness a figure representing the average cost of repairs and renewals of these parts, but it would seem liberal to allow 1.5 cents per locomotive mile, this being equivalent to an allowance of something over $400 per annum per locomotive. Taking this figure and adding the estimated costs of repairs and renewals of electric equipment, we have 2.5 cents per locomotive mile as the estimated total cost of repairs and renewals of electric locomotives, performing the average work now done by steam locomotives.

In 1904 the aggregate revenue train mileage operated was about 1,050,000,000. To cover locomotive mileage in switching, operating work trains and pushers we assume 1,300,000 locomotive miles. In 1904 the aggregate repairs and renewals of locomotives was $105,633,752, the average cost per locomotive mile, therefore, being 8.1 cents. A reduction to 2.5 cents, therefore, is equivalent to a saving of 70 per cent. in the cost of this item, or 5.256 per cent. of operating expenses, reducing this item to 2.253 per cent. of total operating expenses under electric operation.

Item "repairs and renewals of passenger cars." In cases where electric locomotives are substituted for steam locomotives, there should be some reduction in this item. Painting should be considerably reduced by reason of the elimination of smoke. The life of the upholstery and interior decoration of the car will be increased. No reduction has been made, however, in this estimate.

Item "repairs and renewals of freight cars." This item will be favorably and very materially affected if it should ever prove practicable to operate heavy freight trains by locomotives located at intervals throughout the trains and controlled by the multiple unit system. Assuming that the methods of train operation remain the same, the adoption of electricity will still effect a reduction, for two reasons, viz.:

1. The practical elimination of damage by fire which now frequently is superimposed upon damage caused by collision or derailment.

2. Reducing the wear and tear of wheels and brake equipment in descending long grades, by reason of the opportunity afforded to brake the trains by causing the motors to operate as generators. In the way of an estimate nothing more definite than a guess can be advanced. In the opinion of the writers the general substitution of electricity for steam operation in freight service should reduce this item from 7.657 per cent. to something like 6 per cent. of operating expenses.

Item "repairs and renewals of work cars" will not be changed materially.

Item "repairs and renewals of marine equipment" obviously will not be changed.

Item "repairs and renewals of shop machinery and tools" will be reduced under electric operation since the repairs to locomotives will be radically decreased as shown and since the tool equipment required for the electrical machinery is materially less expensive and varied. It would seem reasonable to expect that this item would be reduced from 0.662 per cent. to about 0.5 per cent. of total operating expenses.

Item "stationery and printing" will not be changed.

Item "other expenses." We estimate that this will be reduced from 0.562 per cent. to about 0.4 per cent.

Conducting Transportation.

Item "superintendence" will not be changed.

Item "engine and roundhouse men" includes, in addition to the engine crew, roundhouse men, whose work, of course, is chiefly in connection with the cleaning and maintenance of the engines. This item averages for the railroads of the United States 9.451 per cent. of the operating expenses, of which 91 per cent., or about 8.6 per cent. of the operating expenses are for enginemen and for firemen. Of this 8.6 per cent. approximately 5.5 per cent. is for enginemen and 3.1 per cent. for firemen.

In considering the substitution of the electric locomotive for the steam locomotive it is obvious that the change eliminates the work which the fireman is employed to perform. Under average conditions the services of thoroughly competent motormen can be obtained at a figure which will represent a reduction of 1 per cent. in operating expenses, making this item 4.5 per cent. instead of 5.5 per cent.

The expense for roundhousemen, which under steam operation is about 8.5 per cent., will be greatly reduced both by reason of the reduction in the number of locomotives required for a given service and also by reason of the demonstrated less cost of maintenance per locomotive unit. It is entirely liberal to allow for this item one-fourth of its cost in steam operation, the saving here effected being equal to 0.64 per cent. of the average operating expenses of steam railroads in the United States.

The estimated cost of the item under consideration, therefore, is 4.71 per cent. of total operating expenses.

Item "fuel for locomotives." One of the marked economies resulting from the substitution of the electric motor for the steam locomotive in railway operation is in the reduction of the fuel account. The cost of fuel upon the average steam railway in the United States for the five years, 1901 to 1905, inclusive, constituted 11.292 per cent. of total operating expenses. The aggregate cost in 1905 was $156,429,245.

We estimate that for the operation of the entire freight and passenger service of the United States as existing in 1905, the aggregate energy required at bus-bars of power-houses would approximate 12,500,000,000 kilowatt-hours per annum.

At 0.6 cent per kilowatt-hour the total cost of energy for traction, for the operation of all auxiliaries, and for the supply of light and heat to passenger trains, would closely approximate $76,000,000 per annum. This figure represents a saving of about $80,000,000, as compared with the coal used by steam locomotives in the year 1905. The average cost of this item for five years, viz., 11.292 per cent., would therefore be reduced by electric traction to 5.533 per cent.

Item "water supply for locomotives" is eliminated if electricity be substituted for steam.

Item "oil, tallow and waste for locomotives" should be considerably reduced. We assume that it will be reduced to 0.25 per cent.

Item "other supplies for locomotives." We make no change in this item.

Item "train service" is not changed.

Item "train supplies and expenses." This item among many others includes the following, which will be changed by the substitution of electric motive power, viz.: "Heating, lighting, cleaning and lubricating cars, including the cost of supplying and pumping gas into cars. We have included in the estimate of electric power required energy sufficient to light all cars three hours out of every twenty-four. We have also included energy sufficient to heat all passenger trains by electricity an average of three months per annum. The cost of cleaning the cars should also be reduced by the elimination of smoke and cinders from the locomotives. All things considered, we believe it is fair to assume that under electric operation this item will approximate 1 per cent. of operating expenses.

Item "switchmen, flagmen and watchmen" will not be changed.

Item "telegraph expenses." There will be a slight increase in the cost of this item even under the best plans proposed, and we therefore increase it to 0.2 per cent.

Item "station service." No material change.

Item "station supplies." No change.

Items, "switching charges, balance," "car per diem and mileage, balance" and "hire of equipment, balance" will not be changed.

Item "loss and damage." There should be a material reduction in the charges for loss due to destruction of freight, etc. Another saving will result from the practical elimination by reason of damage of fire, which now not infrequently is caused by sparks from locomotives. These savings will be offset to some extent by damage due to telegraph, telephone or other wires coming in contact with the power circuits, unless reasonable care be exercised in preventing such accidental contact by the adoption of proper precautions when the electric equipment is installed. In our estimate we have reduced this item from 1.112 per cent. to 0.75 per cent.

Item "injuries to persons." We have thought it best in the absence of satisfactory data to leave this practically as it stands, our estimate being 1 per cent.

Item "clearing wrecks." This item will be reduced under electric operation, and it would seem that 0.2 per cent. is a fair estimate of its probable amount.

The following items will not be changed: "Operating marine equipment," "advertising," "outside agencies," "commissions," "stockyards and elevator," "rents of tracks, yard and terminals," "rents of buildings and other property," "stationery and printing" and "other expenses."

General Expenses.

As regards the several items included under the heading "General Expenses," the adoption of electricity will cause no material change.

Recapitulation of Expenses.

	Maintenance: Way and structures.	Maintenance: Of equipment.	Conducting transportation.	General expenses.	Grand total.
Amount in 1905	274,415,279	288,012,604	769,613,017	55,002,127	1,387,043,027
Per cent.: 1905	19.784	20.765	55.486	3.965	100.0
1904.	19.519	19.967	56.670	3.844	100.0
1903.	21.185	19.133	55.893	3.789	100.0
1902.	22.255	19.127	54.671	3.947	100.0
1901.	22.272	18.629	54.979	4.120	100.0
Av'ge for 5 years	21,003	19,524	55,540	3,933	100.0
Cost electricity*	22.354	12.287	43.454	3.933	82.028

*Estimate of cost of operation.

According to our estimate, if all the railways of the United States were to-day operated by electricity, using the single-phase alternating current system at the potential adopted for the equipment of the New Haven Railroad, the energy required for operation being developed by power plants such as are to-day in extensive use and transmitted at potentials well within limits established in practical service, and if the rolling-stock equipment consisted of locomotives and multiple-unit trains, fitted with motors and control apparatus no better than the best which now exist, the aggregate cost of operation, which in 1905 amounted in round numbers to $1,400,000,000, would be reduced by about $250,000,000.

To accomplish this result, power plants delivering about 12,500,000,000 kilowatt-hours per annum would be required. Assuming the radius of transmission from power-houses to be 150 miles, the load factor in railway service should be not less than 0.75, and taking this figure it appears that power plants capable of delivering a maximum output of about 2,800,000 kilowatts will be sufficient to operate the entire railway service of the United States as existing in the year 1905. The average output required is about 10 kilowatts per mile of line and seven kilowatts per mile of track.

In 1905 the average gross earnings of our railroads per mile of line were $9,598, and the average operating expenses $6,409. The foregoing calculations lead to the conclusion that high-class electric equipment now available would reduce this average cost to $5,265. The difference is $1,144 per mile of line, against which apparent saving must be charged the annual interest and depreciation of the power plant, the addition to permanent way equipment, comprising overhead construction and track bonding, the transmission circuits and the sub-stations with their equipment. Assuming 5 per cent. interest on cash cost of these items and allowing 5 per cent. for a sinking fund to cover depreciation of power-house with its equipment and 2½ per cent. for a sinking fund to cover depreciation of the overhead construction and distributing system, the aggregate of fixed charges works out at $837 per mile of line. The saving in operating expenses, therefore, is more than sufficient to take care of the increase of fixed charges. In other words, it appears that the entire railroad system of the United States could be operated to-day at less cost by the electric motor than by the steam locomotive. That the railroads in general if so equipped would realize a large increase in earning power will be admitted by all who have given the subject intelligent attention.

The discussion which followed the reading of the paper was confined chiefly to opinions as to the future of the electric locomotive and to the somewhat academic question of frequency and other details on which it is apparently necessary to agree as to standards.

Mr. Frank J. Sprague in opening the discussion took issue with the authors on the assumption that high potential a. c. operation would be the ultimate solution of the problem of electrification. He believed that direct current at 1,200 or 1,500 volts transmitted through a third rail would give better results in every way than high potential alternating current using the overhead system. He was more concerned with some of the immediate possibilities of limited installations than with generalizations regarding all the railroads in the United States. Some of the railroads are in the hands of receivers and some of the others ought to be. Electrifying them would not take them out of the hands of a receiver, and money could not be raised to electrify them in any event.

Mr. B. J. Arnold was of the opinion that some form of high potential overhead conductor is to be the final solution of the problem. He believed in the third rail, where it was applicable, but did not believe there were many places where, in the future, it could be used. He thought that eventually legislation would be passed which would prohibit the use of the third rail in exposed places, particularly in yards. In designing the installation for the Grand Trunk at the Sarnia tunnel he chose the a. c. system with overhead conductor, for the reason that in the large yards at each end of the tunnel, where much switching is done, it seemed to him essential that the conductor be kept from under the feet of the men. It is interesting to note that the plans for this installation were completed nearly four months before the New Haven road adopted the same system.

Mr. W. B. Potter (General Electric Company) had a word to say with regard to the much-maligned third rail. We have not yet had a chance to malign some of the overhead construction, and it might be just as well to wait a while before giving a verdict.

Mr. W. S. Murray (Electrical Engineer, New York, New Haven & Hartford) presented some interesting figures on the repairs and renewals of locomotives. The repair item for the electric locomotives of the Valtellina line, covering a period of something over two years, is 1.8 cents per mile. In order to get a comparative figure for steam locomotives he had taken the charges for repairs on 20 locomotives in passenger service and 20 locomotives in freight service. The cost per locomotive mile for passenger engines was 5.6 cents and for freight locomotives 6.68 cents. For the passenger locomotives the shop repairs amounted to 3.88 cents per mile, and the maintenance charges, including cost of oil and waste, flues cleaned, engines wiped and turned, boilers washed, etc., was 1.72 cents.

Mr. William McClellan (Westinghouse, Church, Kerr & Co.) strongly endorsed the high potential overhead trolley a. c. single-phase system, in view of the satisfactory results obtained in the electrification of the Rochester branch of the Erie Railroad. With regard to the cost of locomotive repairs he said that in making estimates of this item they had assumed that an electric locomotive would cost for maintenance five-sixths of the cost of a steam locomotive on the basis that the boiler repairs of a steam locomotive amount to one-sixth of the total repairs, and that the repairs to machinery and running gear for steam and electric locomotives would be the same. He pointed out that figures of maintenance given by European roads were misleading, for the reason that the cost of labor is much less in Europe, and also that more care is taken in the operation of the machines; nor did he believe in basing assumptions on the cost of repairs to an electric locomotive running on a test track, no matter what the service may have been, because in that case the machine was in the hands of a competent motorman at all times, but in practice it would probably be misused by more or less incompetent men.

A New Method of Car Recording at Local Stations.

BY F. LINCOLN HUTCHINS.

The ideal car record is one which requires no indexing, or recording, other than is afforded by an individual unit record made at the initial point where movement begins. Such a record is both simple and available, but until ready to adopt this labor and time-saving method it may interest those having to do with car records

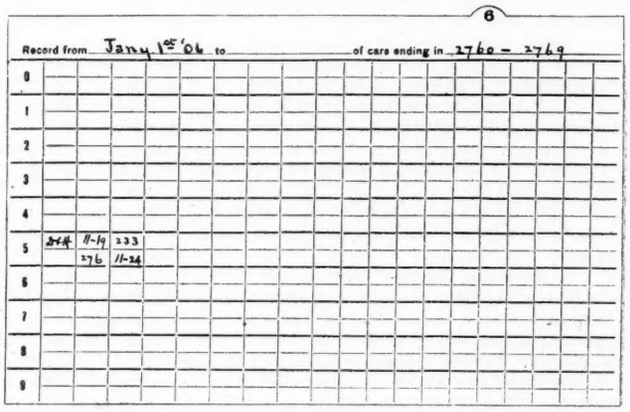


Fig. 1.

to know about a card record system, which has been in use with very satisfying results, at the Troy, N. Y., station of the Boston & Maine Railroad and at various other points for a shorter period.

One thousand, five by eight, index cards, properly ruled and printed upon both sides as shown in Fig. 1, are placed in four trays, which are set in flush with the top of a flat top desk or table; between each set of ten cards are placed guide cards numbered consecutively from 0 to 99; the cards themselves have small tabs projecting above the top edge of the card numbered from 0 to 9; while upon the card itself there are ten lines numbered from 0 to 9. It is, therefore, apparent that there is a certain definite line for recording all car numbers up to a limit of four numbers, viz., the guide cards providing for all hundreds from 0 to 9,900; the small tabs all tens from 0 to 9, and the lines upon the cards for all the digits.

As an illustration note the record of D. & H. C. car number 2,765 in Fig. 1, which shows upon the fifth line, upon card with tab six, and which belongs behind guide card 27.

Particular attention is called to the device of having the number line divided into two parts by a line through the middle. This serves a very useful and important checking purpose as well as making the record more legible.

The operation of the method can be described as follows: The recording clerk sitting at the desk has, say, an inward list before him, either in book or slip form, as is the practice of the yard force; suppose it to be the full record of cars brought in by train 276, engine 2,734; Holton conductor; arriving in yard at 10.25 p.m., November 19, 1906.

The first car upon this list may be D. & H. 2,765; the clerk therefore pulls toward him all the cards which are in front of the one having tab 6 behind card 27; taking that card out he writes

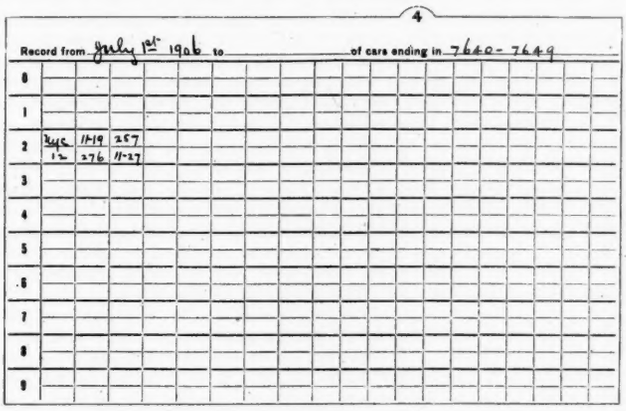


Fig. 2.

in the upper portion of the first blank space in line five the initials D. & H., and immediately against it and still above the dividing line, the date, immediately below it and under the dividing line the train number, then the record will appear thus:

D. & H. 11-19
276

The next car upon the list may be N. Y. C. 127,642; ignoring for the moment the first two figures (12), he pulls forward guide 76, takes card tabbed 4 and upon line two makes entry above the line of initial N. Y. C., immediately below it the first two figures (12), they being considered as part of the initial; places the date in the upper and the train in the lower as in the above example, when the record appears thus: (Fig. 2.)

N. Y. C. 11-19
12 276

When cars go forward the record is completed by adding the movement, but with the date and train number reversed, thus:

D. H. C. 11-19 233 N. Y. C. 11-19 257
276 11-24 12 276 11-27

At junction points where cars are exchanged with other roads a complete record may have four entries; for instance, the yard slips may show N. Y. C. 47,654 to have arrived on train 236, Dec. 28th, delivered to the C., B. & Q., received from the C. & N.-W. and then outward on train 255, when the record upon the card will appear as follows: (Fig. 3.)

N. Y. C. 12-28 Q 1-6 255
4 236 12-29 N.W. 1-10

It is supposed that this record is made by the L. S. & M. S. at Chicago; the illustration, Fig. 3, will show that in order to look up a record all that is necessary is to pull forward the cards in front of the one having the record when the whole continuous record appears at a glance.

When a card is filled with records across the lines it may be still retained in the file for reference, or better, it may be placed in a permanent file where the accumulation of years may be kept together without confusion or trouble in locating old records. The reversing of the date and train is a very important feature, as it checks the work of the number taker and the recording clerk; it also makes the record clearer and more easily read.

The recording clerk starting with his received record knows that all his dates come in the upper portion of the line, and as no two dates can come adjacent he is automatically stopped from mixing up the records; should two dates come together he would know at once that something was wrong; he may have a forwarded in place of a received record; the preceding forwarded record may have been skipped; the number or the initial may be wrong; any one of these errors might not have been so readily discovered and corrected without this checking device.

This method makes a continuous record and brings all records together in sequence no matter for how many years they are retained, either in the current or permanent file; there is no going from book to book, nor from page to page to find any record. More

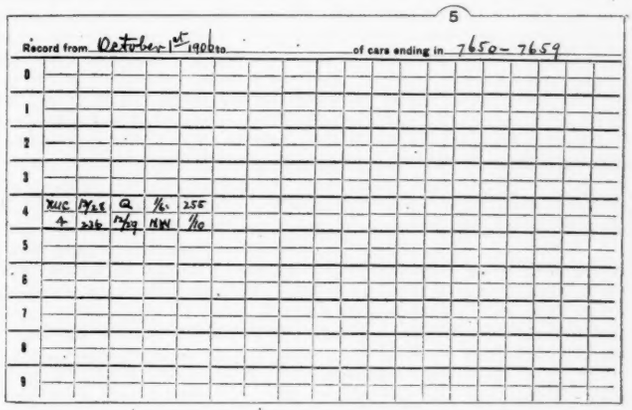


Fig. 3.

than this, it is much easier kept and referred to than any book or slip record.

Printing the cards upon both sides in reverse position makes it possible to use five hundred in place of one thousand cards, the odd numbers appearing upon the front and the even numbers upon the reverse side, but it is recommended that the lines upon the back be reserved for the records of those cars which outnumber the others upon the face of the card so that the card may be used for as long a time as possible and thus facilitating reference.

Such record is practical for the largest as well as the smallest station; in the latter case one set of cards will last a very long period, while in the former they will be exhausted and new ones required oftener.

The time necessary to make the records is from 30 to 90 per cent. less, according to the style of indexing now in use.

First Report of the Interstate Commerce Commission on the Coal Traffic.

The Interstate Commerce Commission has transmitted to Congress its first report on its investigation of discriminations and monopolies under the joint resolution of Congress of March 7, 1906. The report deals with bituminous coal carried east of the Ohio river, and in territory bounded on the south by the Norfolk & Western Railway, on the north by Canada, and on the east by the Atlantic seaboard. The roads involved are the Norfolk & Western, Chesapeake & Ohio, Baltimore & Ohio, Pennsylvania, Buffalo, Rochester & Pittsburg, Beech Creek division of the New York Central, Pittsburg, Shawmut & Northern, Buffalo & Susquehanna and West Virginia Central & Pittsburg (now part of the Western Maryland). The report shows that all of the above companies own, directly or by stock ownership in other companies, large interests in coal lands, and such ownership by each company is specifically described.

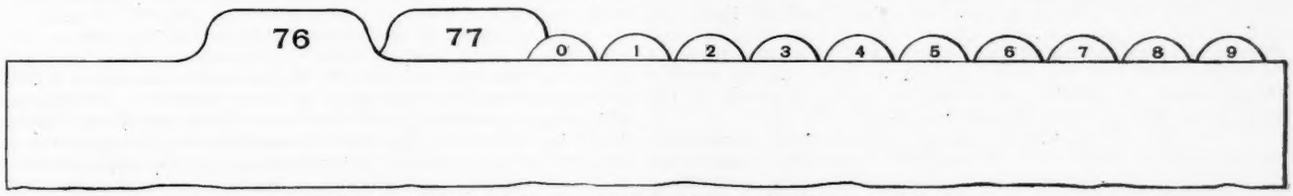


Fig. 4—Sketch Across Top of Box, Showing Cards and Sections.

The interest of railroad officials in corporations or companies operating coal mines or engaged in coal traffic was found to be as follows:

Norfolk & Western.—No officer is shown to have any such interest.

Chesapeake & Ohio.—One officer has an interest in five or six

thousand acres of coal lands in Kentucky, about 30 miles from the line of the Chesapeake & Ohio. There is no coal operation on the land.

Western Maryland.—One officer owns five shares of the capital stock of the Abrahams Creek Coal & Coke Co., par value $100, which he had purchased from the president of the coal company.

Pennsylvania Railroad.—Ownership of stock in coal companies by officers and employees has created a serious and dangerous condition. These officials and employees are of three classes:

(1) Those who, by investment, have purchased interests in coal properties or stock in coal companies, paying the full money value of the property or stock purchased.

(2) Those who, joining with others holding options on or titles to coal properties, acquired interest therein by promoting or allowing the use of their names as promoters, thereby acquiring stock at little or no cost to themselves.

(3) Those to whom stock in coal companies was given outright by promoters.

As to the first class, the policy of permitting officials and employees of railroad companies to hold investments in coal companies furnishing traffic to the railroad is, in the opinion of the Commission, a mistaken policy and is responsible for favoritism. In any event, it subjects such officers and employees to criticism and suspicion. The policy should be speedily changed and the practices thereunder forbidden.

As to the second class, this system was used to a large extent by persons outside of officers and employees of the road to advance their own interest and to enlarge the shipments from the coal properties they were operating, the purpose being to secure by means of the influence of railroad officials and employees undue and unjust advantage over other coal companies having no such affiliations. A number of officers and employees, from responsible officers of the road down to the local car distributers and chief clerks of the division superintendents, have adopted this method of securing stock—that is to say, in some cases by hardly any payment at all and in others by outright gifts of stock. This policy and practice should be abolished, as it brings discredit upon the management and is responsible for various and grave injuries to persons conducting a legitimate and independent business in coal mining without any association with the officials and employees of railroads. It is a significant fact that, so far as the evidence goes, those companies organized to include railroad officers and employees as stockholders have prospered much more than their competitors who have no such associations.

As to the third class, the officers and employees to whom stock in coal companies was given outright, without subterfuge or even pretense of purchase, this system was frequently resorted to, and the officers and managers of the coal companies usually selected the officers and employees of the railroad whose influence it was thought desirable to secure. This practice has grown to be a scandal on the Pennsylvania, and no one who appeared before the Commission attempted to justify it. The Commission cannot too strongly express its disapproval of these practices.

Notice is taken of an executive order issued by the president of this railroad company on July 5 last requiring all officers and employees to divest themselves of any interest, direct or indirect, they may have in stock of any coal companies or firms, or with any individual owning or operating mines located on the Pennsylvania system, or dealing in coals produced therefrom; and also to divest themselves of any interest, direct or indirect, that they may have in any companies or firms, or with any individuals, engaged in any other business, where the holding of such interest might in any way conflict with their duty to the company or the company's duty to the public.

Baltimore & Ohio.—Ten officials of this company own an aggregate of $717,800 par value in shares of stock of coal companies which have their plants on and are doing business along the lines of the Baltimore & Ohio. This stock was acquired in some cases by purchase and in others by allotment as a bonus with bonds purchased, and in a few instances by gift. The criticism applied to practices on the Pennsylvania applies to these practices on the part of the officials of the Baltimore & Ohio.

New York Central.—No ownership by any officer or employee of the stock or bonds of coal companies is disclosed, except that certain shares of the Beech Creek Coal & Coke Company, of the Clearfield Bituminous Coal Corporation, and underlying companies, in which the New York Central has stock interests, were issued in the names of certain officers of the railroad company to qualify them as directors of those coal companies, that they might represent the holdings of the railroad company.

Buffalo & Susquehanna.—There was no evidence disclosing ownership in coal companies by any officer or employee of this company.

Buffalo, Rochester & Pittsburg.—There was no evidence disclosing ownership by an officer or employee of this company in coal companies, other than the interest of President A. C. Yates in the Pittsburg Gas Coal Company, and that the Iselin family own a majority of the stock of the railroad company and also a controlling interest in the Cowanshannock Coal & Coke Company.

Pittsburg, Shawmut & Northern.—There was no evidence disclosing ownership in coal companies by any officer or employee of this road.

In regard to contracts in the form of trust or conspiracies in restraint of trade, the Commission finds in the Associated Railways of Virginia and the Carolinas an agreement among the several railroads parties thereto not to reduce coal rates without consultation, and the inference is that the consent of the railroad companies represented in the association is required.

In the Tidewater Bituminous Steam Coal Traffic Association the Commission finds that certain percentages were agreed upon as to the traffic to be carried by each road, which were never enforced as contemplated by the association by-laws. Nevertheless, the minutes of the association show clearly that there has been a joint agreement from the organization of this association to the present time between all of the carriers parties thereto, fixing the rates upon each road for the transportation of bituminous tidewater coal. This finding covers, in the opinion of the Commission, the real purpose of the continued life of the association after the other purposes of the association seem to have been abandoned.

In the Eastern New York and New England All-Rail Bituminous Coal Traffic Association, the purpose of the association was to see that the prices of coal and freight rates were maintained, and if any railroad company party to the agreement did not maintain such prices and rates, they were subject to such action as the executive committee might advise. The minutes of one meeting show that the principal question for discussion was that of restriction of shipments to the markets covered by the association. The matters in dispute which were not adjusted or decided by the executive committee or at a meeting of the association were referred to the presidents of the roads, who would continue negotiations until an agreement was reached. This association, by joint action, fixed rates for all roads parties to the association, and at the meeting of March 8, 1905, changed for the first time the form of resolution fixing the rates and set forth an "individual announcement" that existing rates would be continued. This, the Commission finds, was the same as the previous agreements as to rates.

In the Bureau of Bituminous Coal Statistics, Buffalo district, originally called the Buffalo Coal Association, the principal purpose seems to have been the maintenance of rates between the parties.

In the Railway Association of Eastern Ohio and Western Pennsylvania, located at Pittsburg, which is described as a "statistical bureau," the evidence as to results attained is very meager, but at the last last meeting, in February, 1906, there were at least forty persons present, representing the different roads composing the association. It is probable that further facts as to this association may be developed in subsequent investigations.

In the Ohio Coal Traffic Association, at Columbus, Ohio, an agreement appears as to rates by all of the roads, although in many instances rates are fixed thereby which should be competitive. The whole purpose of the association seems to be the maintenance of agreed rates on coal traffic. Apparently the original purpose was to apportion the territory and tonnage among the several railroads on agreed percentages, and to make up the deficit of any road not carrying its agreed percentage, either in money payment or, in some other way, and to penalize those roads which carried more than their agreed percentages, and further to fix and agree upon the rates at which coal was to be carried upon the several roads.

While it may appear that the original purposes of these associations were not carried out as set forth in the by-laws or agreements, still it was apparent to the Commission that the associations were used for the purpose of agreeing upon and maintaining freight rates, and that the distribution of tonnage to the several roads was only maintained in so far as the same was accomplished by fixing agreed freight rates.

Under the head of monopoly of any part of the trade or commerce in coal or traffic therein, evidence concerning the "community of interest" between the Pennsylvania, Baltimore & Ohio, Norfolk & Western, Chesapeake & Ohio, New York Central, and Philadelphia & Reading, is considered. The associations having failed to accomplish the desired purposes, the Pennsylvania determined to buy sufficient of the stocks of the Chesapeake & Ohio, Baltimore & Ohio, and Norfolk & Western, so that acting with others it might control the policy of these roads. The ownership thus acquired by the Pennsylvania and also by that system and the New York Central is stated. The Commission reaches the conclusion, aside from the question whether the Pennsylvania had a majority of the stock of the other railroad companies mentioned, except the New York Central, that as a matter of fact the Baltimore & Ohio, Chesapeake & Ohio, Norfolk & Western and Philadelphia & Reading were practically controlled by the Pennsylvania and the New York Central, and that the result was to practically abolish substantial competition between the carriers of coal in the territory under consideration. Since the taking of evidence in this investigation, the Commission is advised through the public press of the

sale by the Pennsylvania of its stocks of the Baltimore & Ohio, Chesapeake & Ohio, and Norfolk & Western, or a part thereof, but who is to become finally the owner of these stocks the Commission is not advised. The action on the part of the Pennsylvania appears to the Commission as a recognition of the public demand that there should not be stock ownership by one road engaged in interstate commerce in a substantial competitor also engaged in interstate commerce.

The ownership or interest in coal properties or coal traffic by carriers or their officers or employees has, in the opinion of the Commission, brought about discriminations, injustice and inequalities in the service to independent operators, and has prevented many persons who desired to engage in mining coal from doing so, and such relationship on the part of the carrier company or its officers and employees has produced suspicion, oftentimes well-founded, and complaints which bring upon the carrier company and its officers and employees—whether guilty of discrimination or not—the enmity and ill feeling of those who, if treated fairly, should sustain and aid the carrier in its useful development. In some instances the effect of such ownership has been to stimulate abnormally the favored companies. Competition has been to some extent hampered from the fact that persons were not permitted to develop their properties, the whole tendency of which would be to increase the price of coal to the general public. The combinations or contracts of the carriers, members of the associations mentioned, has had the effect of increasing freight rates and also the price of coal to the consumers.

The report of the Commission goes into car supply and car distribution in detail for each road, giving full statements concerning the practices of the several carriers, with comment and criticisms based on the facts disclosed as follows:

First.—It appears to the Commission that one of the most fruitful sources of complaint by shippers, as far as car distribution and the furnishing of facilities is concerned, has grown out of the want of publicity on the part of the carriers in their dealings with shippers. The situation has been such on the roads where there has been the greatest amount of discrimination and favoritism that shippers were unable to ascertain accurately what was the system of car distribution in effect, and information was not given, and in some instances was refused, as to whether the system supposed to be in effect was faithfully and fairly carried out. If the carriers had conducted their business with shippers openly and had furnished information as to car distribution, to which shippers were entitled, much of the favoritism would have been averted and wherever unjust suspicions were aroused, the fact that they were incorrect would have readily appeared. In two instances, to wit, the Pennsylvania and the Baltimore & Ohio, it was almost impossible for the shipper to ascertain accurately what was the system of car distribution, and whether it was faithfully carried out. Especially as to coal-car distribution, the best safeguard to the rights of shippers is publicity in connection with all the public duties of the carriers, and whenever there has been a car distribution the details of which were open to the inspection of shippers, while there may have been complaints by shippers of not receiving as many cars as they required, still there has been little or no complaint as to unfairness of the carrier as between shippers.

Second.—The method of rating mines on those roads where the capacity of the mines to produce coal is an element considered in the distribution of cars to the several divisions or districts and mines has not been carried out with the care or fairness which should characterize such responsible and important duties. In some cases men have been employed for this purpose with no previous experience which would justify intrusting such work to them, and in other instances this difficult task has been conducted in a way which fostered suspicion and dissatisfaction. If capacity of mines is to govern in the rating for car distribution, the persons or companies owning the mines should be fairly represented when such a rating is made. Many inequalities and unjust methods are used in arriving at the capacity of each mine. For illustration: On the Baltimore & Ohio and the Pennsylvania, and probably elsewhere, if one company owns more than one mine a car distribution is made to it based on the capacity of all of its mines, which equipment it may divide among the mines owned by it as it pleases, the result of which is that the company frequently closes down one or two mines, and all the cars due to it are sent to the mines which are being operated until the capacity of these latter mines is run up, and then, by the same process, the capacity of the mines which were closed down is increased. This is done for the purpose of working up a larger rated capacity for each mine than it could have if it had only the cars to which it was entitled, and it is unfair and unjust to the company or person owning but one mine and should not be permitted.

Third.—The stock ownership by the Pennsylvania and the New York Central in other carrier companies within the territory covered by this report tends to eliminate competition in rates which might otherwise exist between the railroads carrying coal to tidewater and to diminish competition of tidewater coal with all-rail coal. It is strenuously claimed on the part of the Pennsylvania that the acquisition of the stocks of the Baltimore & Ohio, the Chesapeake & Ohio and the Norfolk & Western by the Pennsylvania was the real cause for the cessation in rebates, which seems to have taken place immediately after the stocks in these companies were acquired. This claim in part seems to be justified.

At the same time the Pennsylvania claims that there is no evidence in the record to show that the Pennsylvania Railroad Company or any of its officers have either directly or indirectly attempted to affect in any way the rates on any of these roads, but that instead the evidence distinctly shows that no such effort on the part of the Pennsylvania or its officers has been made. It is difficult for the Commission to understand how the Pennsylvania Railroad Company's purchase of stock in these competing roads could have brought about a cessation of rebates on the roads of the other companies unless the Pennsylvania exercised its control over the rates of these companies by reason of its stock ownership; and while the use of its power by the Pennsylvania in that particular contributed to the maintenance of lawfully established rates, still the result shows the existence of the power.

Some discussion was had before the Commission, when the effect of the stock ownership above referred to was being considered, as to the differential in rates between the Pennsylvania and other coal fields, and the question was raised whether the Pennsylvania had the power to fix these differentials, and there was also evidence raising the question whether this stock ownership has unduly increased rates on bituminous coal to northern points, but these matters were not before the Commission under the resolution of Congress above referred and its investigation was not undertaken.

Fourth.—On the Pennsylvania and the Baltimore & Ohio a very large part of the shipments of coal is carried in what are known as "individual cars" owned by coal operators along the lines of these two roads. These cars are bought and paid for by the individual operator and then are put into their service exclusively by the railroad company, and for their use an allowance is made to the owner of the car of 6 mills per mile, which sum, however, is insufficient to pay the interest on the money invested, but the operator gets an incidental benefit in the amount of coal which he can thereby get to market and the regularity of car service. Nearly every railroad officer and coal operator who was examined on the subject of "individual cars" condemned their use. It has appeared in the evidence that the Pennsylvania during the fall of 1902 sold to the Berwind-White Coal Mining Co. 1,000 cars, or the contracts therefor, to be used by the latter company as its "individual cars," and during the same period the Pennsylvania sold to the Keystone Coal & Coke Co. 500 cars which were being built for the railroad, and at about the same time the Pennsylvania leased 700 cars from its equipment to J. W. Ellsworth & Co. About a year after a report was made to President Cassatt, by a committee of officers, recommending that the equipment of the company be increased, looking toward the final elimination of the "individual car." The reasons for the abolition of the "individual car," as given by the committee, are as follows:

> Reduction of switching in terminal and intermediate yards, reduction in empty-car mileage, elimination of tracing and special movements made at owners' request, the saving in yard and clerical forces, which, measured in money, is estimated at $225,000 per year for the lines east of Pittsburg, and at $50,000 per year were it possible to do away with the individual cars on the lines west of Pittsburg.
>
> From a traffic or commercial standpoint.
>
> The avoidance of constant irritation and jealousies from suspicion of preferences and the avoidance of charges of discrimination, it being assumed that the railroad company is prepared to furnish regular supply of cars.
>
> It cannot be denied with our limited freight-car equipment the use of individual cars materially assists in taking care of important shipments, insuring to these interests a regular supply of cars, and if the cars are then taken over by the railroad companies and the cars are divided strictly on basis of production, there may be times when the railroad company will be unable to handle important items of traffic at the proper times.

So it will be seen that within about one year following the sale and leasing of 2,200 cars by the Pennsylvania a committee of its officers recommended the abolition of "individual cars." In the opinion of the Commission the use of "individual cars" is a source of discrimination, inequality, and unfairness in the service rendered to the shippers by the carriers, and steps should be taken at the earliest possible moment to abolish their use in the coal service.

Fifth.—Another source of discrimination in the system of car distribution is the assignment of cars to certain operations for fuel coal or company coal without charging such cars against the pro-rata distributive shares in the equipment of the road; in other words, treating such assigned cars as arbitrary cars and not counting them against the percentage to which the operator receiving them is entitled. This method of distributing cars interferes with and to a certain extent nullifies any fair system of distribution which may be put into effect, creates inequalities and injustice as between shippers, and is frequently used by the railroad company to enable it to get its fuel supply at less than the market price for coal, and amounts to an arbitrary assignment of cars in considera-

tion of the difference between the price the company has to pay for fuel coal and the market price.

The recommendations of the Commission are as follows:

First.—That every common carrier be required to make public the system of car distribution in effect upon its railroad, showing how the equipment for coal service is divided between the different divisions of its road and how in times when the supply of equipment does not equal the demand it is divided among the several mining operations along such road, and that the carrier further be required to publish at stated periods and at each divisional headquarters the system of car distribution in effect and the actual distribution made to each mining operation under such system.

Second.—That where the capacity of the mines is the basis for the distribution of equipment, a fair, just and equitable rating of the mines be required, and that provision be made for the representation of owners of the mines at the rating thereof.

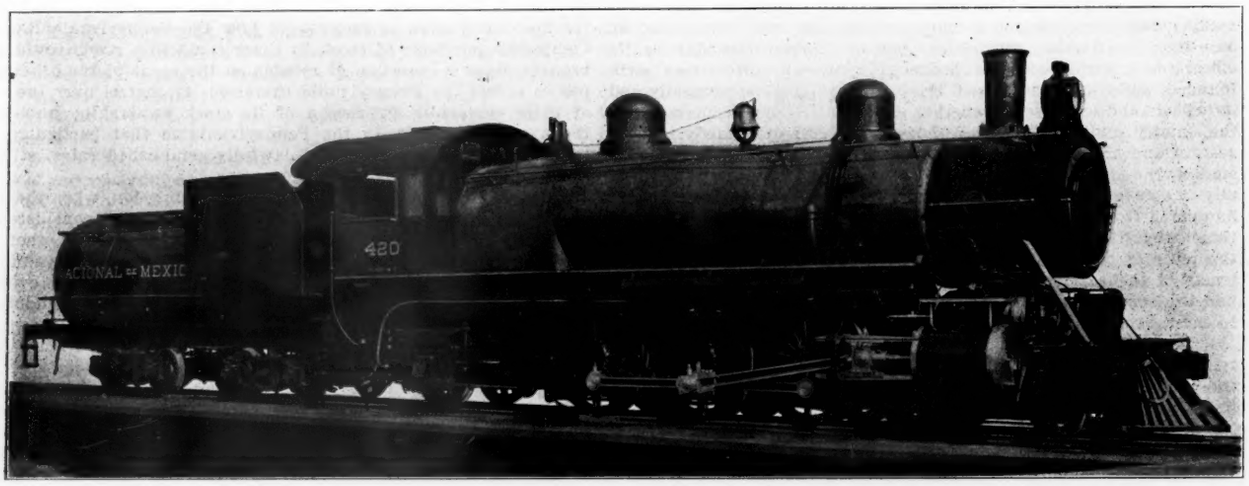
Third.—That after reasonable time carriers engaged in interstate commerce be prohibited from using "individual" or "private" cars for the handling of coal traffic; and, further, that when a carrier is unable to furnish all the cars required by all the shippers upon its line, all cars in service on the road, excepting individual or privately owned cars until their use is prohibited, be treated as the equipment of the company and subject to distribution according to the system or plan in effect at that time.

Fourth.—That carriers engaged in interstate commerce be forbidden after reasonable time to own or have any interest, directly or indirectly, in any operated coal properties, except such as are exclusively for their own fuel supply, and that ownership, either directly or indirectly, by officers or employees of common carriers of any coal properties or any of the stock of coal companies, along the line of road by which they are employed, be forbidden.

After further investigation the Commission will make another report.

Balanced Pacific Type Locomotive for the National of Mexico.

The Baldwin Locomotive Works has recently delivered a four-cylinder balanced compound locomotive of the Pacific (4-6-2) type to the National Railway of Mexico that possesses some interesting features. With engines of this type the forward driving wheels set so well to the front that either the connecting rod for the inside cylinders must be bifurcated in order to span this axle or the cylinders themselves must project beyond the line of the smoke-box in order that their work may be done on the forward axle. In this design the bifurcated connecting rod was chosen and the cylinders placed in the same horizontal line, by which all four are coupled to the second pair of driving wheels. In the case of the bifurcated rods, the front end is provided with lips which bear against the body of the stub so that the bolts are relieved of all shearing stress. The brass is split and is provided with a wedge adjustment. At the back end the stub is fitted with the usual strap and key.

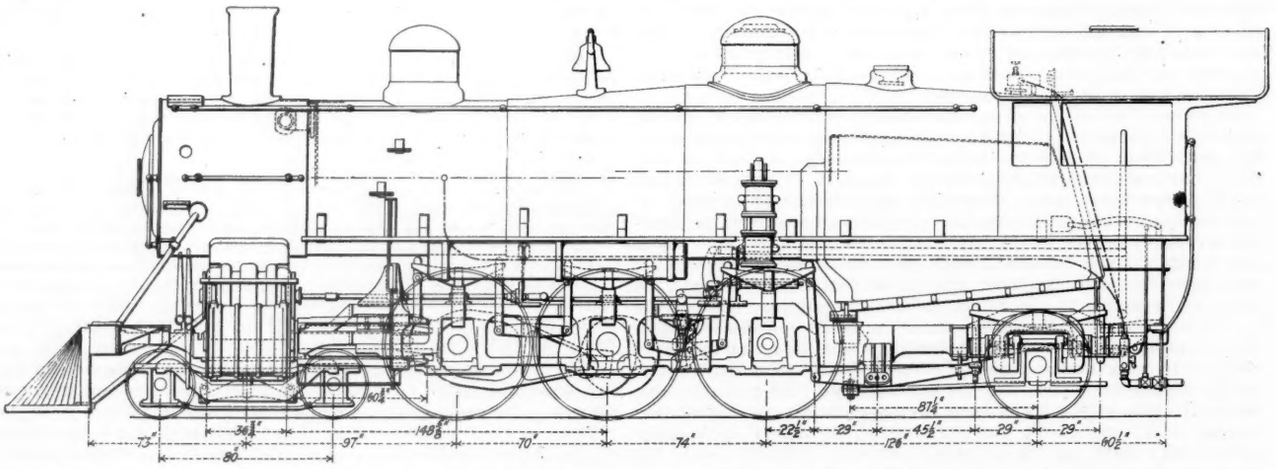


Pacific (4-6-2) Type Locomotive for the National Railway of Mexico.

One piston valve is made to serve one set of cylinders, and this is driven by a Stephenson link motion with the eccentric on the third or rear driving axle. This arrangement, made necessary by the use of the built-up crank axle, requires that the valve rod should be very long. It therefore reaches from a point about midway between the second and third pair of drivers, forward to the cylinder. In order that it may not buckle, but may work properly, it is supported at two points, and is provided with a knuckle joint in addition, as shown on the side elevation.

The crank axle is built up of seven pieces in accordance with the general design that has been adopted by these works. The crank cheeks are circular and the central member is of cast-steel.

A peculiarity of the frames is that they are given an offset outwardly at the driving boxes in order to obtain a greater length



General Elevation; Pacific (4-6-2) Type Locomotive for the National Railway of Mexico.

of box than would be possible with the frames held in to the distance of 44 in. between centers, that prevails at other points along their length. This offset amounts to ¾ in. on each side, making the distance between frame centers 45½ in. By this means a journal length of 10 in. is obtained between the crank cheek and the inside face of the wheel hub.

At the rear the Rushton trailing truck is used. In this the box is held rigidly between the pedestals and the cast-steel equalizer, or spring seat, is suspended directly on the spring links. The bearings for these spring links are bolted to a supplemental frame, which is secured to the main frame by means of cast-steel brackets.

The steam pressure shows the tendency to increase that has marked American practice for some time, and is well up to the top notch of what has been used in actual practice. Whether this exceedingly high pressure is really economical or not, is a matter that is as yet undecided, and which can only be settled by a thorough investigation coupled with actual working effects.

Another point of peculiarity, in that it is not a widespread practice, is the use of the cylindrical tank, that possesses the advantage of a high capacity coupled with the freedom from internal staying, to which must be added that of perfect accessibility of the running gear and all parts below the frames.

The following are some of the principal dimensions of this engine:

Cylinders, diameter	17 in. and 28 in.
Piston, stroke	28 "
Boiler, type	Wagon top
" diameter	70 in.
" thickness of sheets	11/16-in. and ¾-in.
" steam pressure	220 lbs.
Fuel	Soft coal
Firebox, length	113½ in.
" width	66¼ "
" depth, front	75¾ "
" depth, back	61¾ "
" thickness of sheets, sides, back and crown	⅜ in.
" thickness of tube sheet	½-in.
" material	Steel
" water space, front	4½ in.
" water space, sides and back	4 "
Tubes, material	Steel
" number	301
" diameter	2¼ in.
" length	20 ft.
Heating surface, firebox	186 sq. ft.
" " tubes	3,527 "
" " total	3,713 "
Grate area	52.1 "
Wheels, driving, diameter	67 in.
" front truck, diameter	30 "
" rear truck, diameter	48 "
Journals, main driving	11 in. x 10 in.
" other driving	9 " x 12 "
" front truck	6 " x 10 "
" rear truck	8 " x 14 "
Wheel base, driving	12 ft. 0 in.
" " total	33 " 11 "
" " engine and tender	62 " 11 "
Weight, on driving wheels	147,040 lbs.
" " front truck wheels	45,300 "
" " rear truck wheels	35,000 "
" total engine	227,340 "
" engine and tender (about)	370,000 "
Tender, water capacity	7,500 gals.
Tender, coal capacity	12 tons.
Service	Passenger
Tractive effort	35,720 lbs.

$$\frac{\text{Weight on drivers}}{\text{Tractive effort}} = \text{factor of adhesion} = 4.11$$

$$\frac{\text{Total weight}}{\text{Tractive effort}} = 6.36$$

$$\frac{\text{Tractive effort x diameter drivers}}{\text{Heating surface}} = 644.55$$

$$\frac{\text{Heating surface}}{\text{Grate area}} = 71.21$$

$$\frac{\text{Firebox heating surface}}{\text{Total heating surface}} = 0.05$$

$$\frac{\text{Weight on drivers}}{\text{Total heating surface}} = 39.16$$

$$\frac{\text{Total weight}}{\text{Total heating surface}} = 61.23$$

Vol. of 2 H. P. cylinders = 7.35 cu. ft.

$$\frac{\text{Total heating surface}}{\text{Vol. 2 H. P. cylinders}} = 505.17$$

$$\frac{\text{Grate area}}{\text{Vol. 2 H. P. cylinders}} = 7.09$$

Equivalent firebox heating surface = 789.04 sq. ft.

Total equated firebox heating surface (Vaughan's formula) = 975.04 sq. ft.

The Prussian Finance Minister in presenting his estimates to Parliament said that while the estimates for 1906 called for $40,000,000 for new rolling stock, the pressure of traffic had led to issuing a loan for $25,000,000 more for that purpose, and this proving insufficient he had exceeded his authority by spending $12,000,000 more. Even this had so far failed of meeting the requirements of traffic that his estimates for 1907 would call for an appropriation of $108,000,000 for further additions to rolling stock; from which it appears that the growth of traffic has exceeded all calculations there as well as here. Coal production in Prussia was 30 per cent. greater in 1906 than in 1905, coke production 33 per cent. greater, pig-iron production 14 per cent. greater, and steel production 20 per cent. greater. Of the latter, 73 per cent. was consumed in Prussia. The total increase in freight traffic was 10⅓ per cent. Advance in rates of pay to employees taking effect this year will absorb $12,500,000 aside from the pay of additional men.

Harriman and Hill Operating Methods Compared.

J. Kruttschnitt, Director of Maintenance and Operation of the Harriman Lines, makes the following reply to a recent editorial in the *Wall Street Journal*:

This article did not treat our lines fairly. After referring to the great work of Mr. Hill, who has challenged the admiration of all of us, it is said that Mr. Harriman has been building "a great financial institution" and that "Union Pacific continues to climb mountain ranges at a 116-ft. grade."

It is true the financial standing of the Union Pacific is a monument to Mr. Harriman's genius, but the rebuilt and reconstructed Union Pacific and Central Pacific lines are quite as much to his credit. The reconstruction of both the Union Pacific and Central Pacific was carried out on broader lines than on any other transcontinental road, and we do not think any line can to-day transport freight more quickly, economically and efficiently than the Union Pacific and Southern Pacific. It should be remembered that the Union Pacific climbs the Rocky Mountains on an 82-ft. and not a 116-ft. grade, and this on double track thoroughly block signaled and heavily ballasted. I am under the impression, gathered from Mr. Hill's time cards, that Great Northern does its heaviest mountain climbing on grades of 116 ft. to the mile and without block signals. In the matter of average train load, and even in the matter of the much misunderstood and misleading operating ratio, our lines do not suffer by comparison, as the following figures will show:

Comparative Operations, Year Ending June 30, 1906.

	Union Pacific System.	Northern Pacific.	Great Northern.
Average miles operated	5,404	5,401	5,906
Per cent., operation to earnings	52.07,† 48.77‡	50.79	50.42
Cost, M.-of-W., per mile of road	1,832,† 1,519‡	1,387	1,093
Tons of new rails laid	67,946	22,560	33,950
Tons of freight carried 1 mile	6,501,411,061	6,126,514,118	5,497,195,987
Passengers carried 1 mile	642,544,422	659,050,227	402,066,841
Passenger-train miles	9,510,740	8,057,721	7,316,332
Passengers per train	66	74	51
Freight-train miles, incldg mixed	12,755,053	13,097,617	9,308,753
Freight locomotive mileage	14,374,122	15,928,957	11,635,950
Excess of freight locomotive miles over freight-train miles	1,619,069	2,831,340	2,327,197
Ratio of above excess, per cent.	13	22	25
Cars per freight train	31.64	31.71	37.09
Tons of freight per loaded car	21.54	20.21	22.33
Tons freight per locomotive mile	452.30	384.61	471.56
Miles run per locomotive owned	35,637	31,468	*29,700
Earnings per train-mile	$3.00	$2.85	$3.08
Expenses per train-mile	$1.56,† $1.56‡	$1.47	$1.55

*Estimated.
†Including reserve fund charged to expenses for future maintenance.
‡Excluding reserve fund charged to expenses for future maintenance.

The following figures are compiled from working time tables:

Average speed of time freights, omitting dead time at terminals:

	Miles per hr.
Great Northern, St. Paul-Seattle:	
No. 401	12.8
No. 402	12.5
Average	12.7
Union Pacific, Council Bluffs-Ogden:	
No. 52	16.1
No. 53	14.1
No. 54	17.5
No. 55	13.2
Average	15.2

The density of traffic is not far different on both roads, yet the Union Pacific runs 5 time freights daily, while the Great Northern runs 2½ time freights daily. Union Pacific also runs many extra fruit specials in small train lots, at very fast speed.

It would thus appear that Mr. Harriman has been able to spare enough time from building a "great financial institution" to devote some attention to the rate of grade at which the Union Pacific climbs mountain ranges, for he seems to have moved his freight trains with only 13 per cent. excess of locomotive over freight train miles, while Mr. Hill shows an excess of 22 per cent. and 25 per cent. The Great Northern train load last year averaged somewhat more than ours, but the locomotive load—which is the better test of comparative loading—was only 19 tons, or 4 per cent. more. When the differences between the two systems are considered, the Great Northern carrying the larger part of its traffic on the comparatively level eastern portion of its system, nearly all of its traffic having no speed requirements, while a large part of Union Pacific

business is composed of California fruits, which is expedited business moved in small train loads, our lines do not suffer by comparison; and the superiority of the physical condition of the Union Pacific, both as to roadway and equipment, is so universally admitted as to need no comment from me. In making comparisons with the Great Northern, the fact must be kept in mind that that road hauls a great deal of lumber, ore and grain, whereas the Union Pacific tonnage is of a more diversified character. We move some coal, but no ore to speak of.

So far as average train load is concerned, we do not attempt to always load locomotives to their maximum rating, our tonnage ratings being based on speed requirements as well as the hauling capacity. Any other policy we consider detrimental to the best interests of our patrons, and, in fact, in the first five months of this fiscal year, in order to haul trains at faster speed, we deliberately reduced our average train load on the Union Pacific 31 tons.

Watching Freight Traffic by Daily Returns.

AMERICAN RAILROADS.

So much has been said and written, and usually somewhat vaguely, of the use of daily statistics by American railroad companies, with resultant comparisons of their use by British railroad companies, that it seems well to make a somewhat detailed examination of this subject. This examination, however, will be limited to the use of statistics for the purpose of securing economy in working, as a substitute, or rather as an aid, to observation and inspection. It will have nothing to do with the preparation and publication of half-yearly or yearly reports.

Economic statistics for railroad working have a value in inverse proportion to the time reported on, that is to say, six-hourly reports, daily reports and perhaps weekly reports have the highest value for the divisional officers, for the reason that the information comes to them quickly on their knowledge and memory of the attendant conditions, and remedies and corrections of waste and dangerous practices can be made at once by the divisional officers.

The American division superintendent may be considered the chief officer of a short piece of railroad, but not an isolated one. While he regulates the local business absolutely, nevertheless, since his road has its mouth open at both ends for through traffic, he must regulate it in conformity with the through schedule trains and other through trains. Although the line which he controls is short and he can easily move, and he frequently does move, from one end to the other and watch the working of the division yards and shops, nevertheless, on the best regulated railroads, he has placed on his desk each morning at 9 o'clock all the statistics of the operations on his division during the previous day from midnight to midnight, and also their comparison with the previous day and corresponding days last month and last year. These statistics are accurate as far as they go, and indicate to him immediately whether or not he is operating economically as well as efficiently. They have the practical advantage that they show the facts of the preceding 24 hours, the true story of actual and present operation, and if the figures suggest that a change in methods is necessary the remedy can be applied at once. Substantially all of this information for the daily report comes by telegraph or telephone, and between midnight and morning the night clerk has time to compile it on the blank forms used for the purpose, and have it ready for the superintendent by the time he comes to his office. During the day, at intervals of six hours, he receives telegraphic reports showing the condition of the terminals or marshalling yards under his control. These six-hourly telegraphic reports are not necessarily sent to his office, they are telegraphed to him wherever he is along the line.

The "Reports Showing Movement and General Condition" show the number of through trains, of loaded cars, empty cars and total cars received and despatched in each direction at each terminal; the same data for those passing a midway point; the total number of time freight trains in each direction with a percentage of those making schedule; the total number of passenger trains in each direction and those making schedule; the weather conditions at each terminal and at a midway point each six hours; the trains delayed in getting into each yard; the trains delayed at yards waiting for power; yard accidents; road accidents; delays due to motive power failures; delays due to car equipment failures; failures or delays due to switches, signals, rail renewals, or any failure of water or coal supply.

The daily "road run" report covers the actual movement of the trains while on the road, and is exclusive of the movement through the yards at the terminals. This gives the length of run of each train, the average time of each class of trains, and the average rate in miles per hour of each class. The data for the through slow freight trains give the maximum, minimum and average times in making trips, and where and why delays or detentions occurred. The maximum, minimum and average tonnage behind the tender, and the maximum, minimum and average number of cars hauled by the engines are given. The freight car movement is reported by the number of loaded and empty cars moved in each direction, together with the number of engines in service.

The "lay-over sheet" is another daily report showing cars awaiting train movement from the yards and from interchange connections for the preceding 24 hours. This sheet also includes the movement passing important points, weather conditions, and so forth. This is received by telegraph and compiled by the night clerk.

Another daily report, which is a compilation of the divisional reports, is made for the general superintendent and for the general manager. This is so designed as to give to the general officer, within the space of an ordinary foolscap page, a thorough knowledge of the freight train work of his railroad during the preceding day. It shows the number of trains and of loaded and empty cars passing the important points on the line, and in order to give condensed information, the cars are reported in separate columns with the totals carried out, and over the separate columns are the initials A. B. and C. "A" indicates full loading or what is called "summer rating," "B" indicates about 5 per cent. less loading, and "C" about 10 per cent. less than full loading. It will be observed that while this does not give to the general superintendent and the general manager the total tonnage, it nevertheless shows them the important facts, *i. e.*, the loaded and empty car movement and the relative loading of cars and engines. This is important inasmuch as it gives them every day sufficiently precise information about the quantity of the traffic and the efficiency of their officers in securing full car loading and full engine loading. This same daily report informs them of the number of cars awaiting train movement at the different stations at six o'clock in the morning. It shows them also the number of cars awaiting transfer to connecting lines; it shows them also the number of cars interchanged during the preceding 24 hours with connecting lines.

One of the most interesting, and probably the most valuable set of statistics kept by the division superintendent, is on what he calls his "cards." These are pieces of Bristol board, 3⅜ in. wide by 7¾ in. long, with round corners. On a division which includes a considerable number of branches, there are liable to be more than 20 of these cards. If the division consists of a section of main line, with few if any branches, the number of cards would be reduced as much as one-half. The cards are ruled and have printed dates opposite each horizontal line, so as to include the record of one month. The statistics are filled in by the clerk each morning, so that the division superintendent has in a form for convenient reference all the data which he thinks he needs from the beginning of the month up to date, and a great deal of this data includes like information for the corresponding day in the previous year, together with increases or decreases carried out. When the division superintendent is at his office, these cards, with a rubber band around them, are apt to lie on his desk for ready reference. From them he can answer most questions asked of him by his superior officers, and he is also enabled by the use of them to reply intelligently and quickly to complaints or suggestions coming from his subordinates, or from customers of the road. When he travels, these cards are in his pocket. For example, his record of passenger trains shows the number of trains run on time each day, together with the percentage of those which kept their schedule and compared with the corresponding day in the previous year; the number of passengers carried, divided into through passengers and local or way passengers; the total car movement; the loaded and empty car movement in each direction; the number of trains; the number of cars in each classified train; the average gross weight behind the tender; and the maximum, minimum and average time of movement; the interchange of cars at junction points; complete data from the yards of the number of cars and cuts made, and of those weighed.

The above is a somewhat incomplete and hasty description of the daily reporting system, and it happens that the example chosen is that of a division on an American railroad where the freight traffic is of overwhelmingly greater importance than the passenger traffic. It has been so chosen for the reason that the economies to be effected in railroad working are much more important, and have a greater money value in the handling of goods and minerals than in the handling of passengers. Passenger train service is necessarily developed by less scientific methods. It is a catering to public convenience and public taste. It can be increased or diminished by so much as the convenience and comfort of those who travel is anticipated.

BRITISH RAILROADS.

In considering the statistics found necessary to keep a close check on the good working and economical handling of British freight traffic, and in comparing them and their results with statistics kept in other countries, we must not overlook the differences in conditions existing. In England the movement of goods and mineral traffic may be said to be fairly steady, and, in consequence, regular or scheduled services have been arranged to all parts of the country, which work with pacticaly the same precision and regularity as passenger trains.

Goods despatched overnight are expected to be delivered at destination the following morning, and if this is not done, the traffic

goes to a competing road. Now, although this system goes on to a limited extent in other large countries, it follows, on account of the long distances to be covered, and the rate conditions, that it can only amount to a very small (it might be said an insignificant) part of the huge freight business they do, and consequently there is much more scope for moving freight economically than on British lines.

On the other hand, atmospheric conditions do not enter to anything like the same extent into the difficulties in working on British railroads as in some countries, nor do accidents, mishaps, etc., to rolling stock, or blockages to traffic occur with the same frequency; in fact, the whole railroad machinery works with comparative smoothness and regularity on the long-established British lines, instead of flowing in abnormal rushes in one direction at one period and perhaps in an entirely different one at another season of the year, as in some of the huge undeveloped countries presenting railroad problems to-day.

The district officer's problem is a much more complex, if not a more difficult one, on British railroads than abroad. Not only does he control the movement of the traffic by trains and engines, but as the company also undertakes the collection and delivery of practically the whole of the merchandise business, a good deal of attention must be given to the punctual working of the traffic through the warehouses, and in the care and management of the huge carting establishments. The same waste in administration and detail may occur in connection with these departments unless very closely watched.

Then, again, there is the question of hours of labor and other conditions of service, as well as the innumerable restrictions which make for the safety of passengers and staff. Probably in no other country do the same stringent conditions apply.

Parliament, too, seems never tired of calling for returns of the hours worked by specified grades of men, and a good deal of adverse criticism and other more effective means are leveled at the heads of railroad companies whose men's hours are not kept down rigorously to the hours stipulated. This results in a large amount of time being devoted to the question, which is certainly not one to help in the direction of the economical movement of traffic.

Now, what does the divisional superintendent watch, and what statistics does he require?

First, he must see that the goods trains, carrying the urgent freight, work approximately as punctually as do passenger trains. To enable him to do this he receives, on his arrival at the office in the early morning, returns or telegrams from all his important stations, showing the departures and arrivals of all his scheduled trains during the previous night and day. These returns have already been assembled on a blank form, which gives a complete picture of this part of the previous day's work done by the express and fast goods trains. It gives for each train the scheduled time and actual time of starting and of arrival; the minutes late; the causes of delay; the number of wagons (loaded and empty); the class of engine; and the weather conditions.

The delays en route are immediately taken up, and the serious blots put right the same day, and the returns are then passed out to be recorded statistically, with the average departures and late arrivals duly worked out. It will, however, be noticed that the individual treatment of the delays suffered by the train are first dealt with before statistical figures are compiled.

Second, he has to consider whether his large scheduled goods-train service of trains which must run are loading to something like the capacity of the engines, and that the service is rearranged whenever the traffic falls off or increases. He does this daily by means of the columns headed "No. of Wagons" and "Class of Engine" on the form above described, and also by the daily record of the loading of his trains and the percentage loaded to maximum or otherwise. For this purpose he has a blank form, filled in day by day throughout the month, showing the loading of each goods and mineral train worked out by percentages to a mineral load basis. This shows the total number of trips, number of trips fully loaded, number of trips three wagons or less short of loading maximum, number of trips four wagons or more short and the percentages of the last three items above. At the end of the month the totals of these daily returns are assembled in a statistical "Summary showing the percentage loading of goods and mineral trains" for each district and summed up in totals, giving the same information for the whole line. In this return comparisons are made with the preceding month and for the corresponding month of the previous year.

Third, he has to move his mineral and similar class traffic, which corresponds to the "heavy freight" in America, and in Great Britain consists of materials and coal, as economically as possible. Even here the traffic is so steady that most of the trains are scheduled, and are dealt with similarly to the merchandise trains, except that if not fully loaded they are not run unless under exceptional circumstances. The surplus is worked by special trains, but with these there is no service necessity to run them if not fully loaded, and as there is not the same fear of congestion on British railroads, the principle adopted is that the man who has authority to order to special power has to report to his district officer, and receives his censure or approval as to the necessity for running any special not fully loaded to the capacity of the engine. These daily and monthly returns and comparisons are used for watching the necessity for specials; and in addition the officer has a daily return of the work done by the special trains. This informs him, concerning each train, of the time ordered and actual time of starting; time the engine is held at the disposal of the traffic department; number of goods wagons; cattle, mineral, fish, empties and total wagons; and for passenger trains, the number of vehicles, loaded, empty and horse boxes; where the train is ordered to go; the class of engine; name of guard or brakeman; and an explanation of the necessity for running the special.

A return of miles per hour obtained from freight engines is compiled weekly and circulated to all district officers showing the miles run by the engines at each shed in their district, and the hours the engines were out, together with comparative figures for the previous year. From these the average miles per hour are easily seen, and with the shunting and stationary return, mentioned in a later paragraph, any falling-off can at once be located.

The full loading of wagons is watched by a system of daily statistical returns, which seem to be adequate for passing judgment and for the immediate correction of abuses. The weights loaded in each wagon are recorded at the stations daily on a form showing in detail the wagon number, destination, description of traffic, and weight of either goods or minerals in each company's wagon, or foreign or private-owned wagon. From this data the average weight per wagon is arrived at. The whole are brought under the notice of the agent in charge first thing in the morning, and any points requiring attention are dealt with. The return is then passed on to the district officer (daily from large stations and weekly from small stations). Further, each station renders a report showing their justification for any wagons sent out with less than full load. These daily returns make it easy clerical work to assemble this information on another form for any desired period, showing the average loading of all traffic in company's and in foreign wagons. They furnish also the information from each station, which is collated on another form of return showing either weekly or monthly the shipments, in tons, of goods, minerals, coal and coke, transfers and gross tonnage. This return includes also the salaries and wages, with cartage separate, and the cost per ton on goods and transfers only. On the same return is an analysis of goods, tonnage received and forwarded, of salaries and wages chargeable to received traffic and forwarded traffic, yards, offices, miscellaneous and total. It includes also a daily average of consignments and rolling stock left over during the period.

A daily report of wagons left over or under load at the close of each day's work is made by all the principal stations to the district officer, showing the wagons on hand not unloaded at the close of the day's work. It may, however, be said here that generally, as to British railroads, the left over items, liable to be so large in American practice, are rare in British practice. The steadier and more uniform conditions here enable the companies usually to do the day's work within the day.

The shunting and stationary times of engines at stations are difficult items to watch, and probably the best form of statistics is the rough and ready method of dividing the number of wagons dealt with into the time occupied at each station. This is recorded on a form rendered to the district officer daily, and in addition to applying to engine switching, it is also used to check horse and capstan switching, and the "shunter's capstan men," and other supervising staff, which is worked out to the average minutes occupied per wagon. This form shows the aggregate time, excluding meal times, occupied in switch engines, train engines and total engines; the time that train engines are standing; and the time of "shunting" horses, inspectors and foremen, of "shunters," of "capstan men" and hookers-on, of shunt horse drivers and mates, and also the total number of wagons dealt with. The summary on the same sheet gives the average number of minutes per wagon for most of the above items, and the like figures for the corresponding day in the previous year. A monthly return from each station is assembled on another form showing the number of wagons handled, the number of hours occupied in shunting by engines, horses and different classes of employees. This is totalled so as to get unit figures for each district and for the whole line. Station and cartage working is watched by a unit measurement, and this unit is the cost per ton. A daily station report shows the hours worked; regular and overtime and total daily wages; the tonnage received and forwarded and the total; the wages cost per ton on the goods; the number of men engaged separately on received and forwarded traffic as regular, extra men, casuals, and hours overtime; the arrears of work at the close of the day; the supply of rolling stock of the different classes, and so forth.

The cartage working is watched by a daily report which records the vans sent out with each kind of load at six different periods during the day. It also records the arrears of work of the previous day and the same day. It gives a summary of the cartage work

done, both by company's teams and hired teams, and the number of loads and tons delivered and collected. It also includes a daily inventory of men and horses and their conditions. The record of the time that traffic is out for delivery is regarded as highly important.

Shortage of Cars in Germany.

The United States Consul at Kehl, Germany, reports that there has for many months been a serious shortage of cars in Germany. All the railroads there are owned and operated by the Government. Consul Britain says in a report to the State Department:

The greatest cause of the scarcity (of cars) is the extraordinary activity in the iron and steel industry. For the first half of 1906 nearly 700,000 more cars of coal, coke and patent fuel were delivered by the syndicate than during the corresponding period of last year, and the daily dispatch of cars has frequently exceeded 21,000 in number.

The Prussian State Railway authorities have been severely criticised in consequence of the shortage of railway cars. Thus, during June, although 221,991 more cars were available than in June, 1905, the shortage amounted to nearly 1,000 cars a day. But, on the other hand, it is questioned whether, even with this shortage made good, it would have been possible to satisfy the demand.

The marked scarcity of cars at this time of the year is all the more disquieting, since the farmers will shortly be drawing heavily upon all available railway rolling stock to move agricultural produce. The result of this deficit in the number of cars supplied has been that in several collieries the mines have been compelled temporarily to stop work, a measure which in these days of high wages is a costly matter.

Atmospheric Railroad Traction.

BY W. B. PALEY.

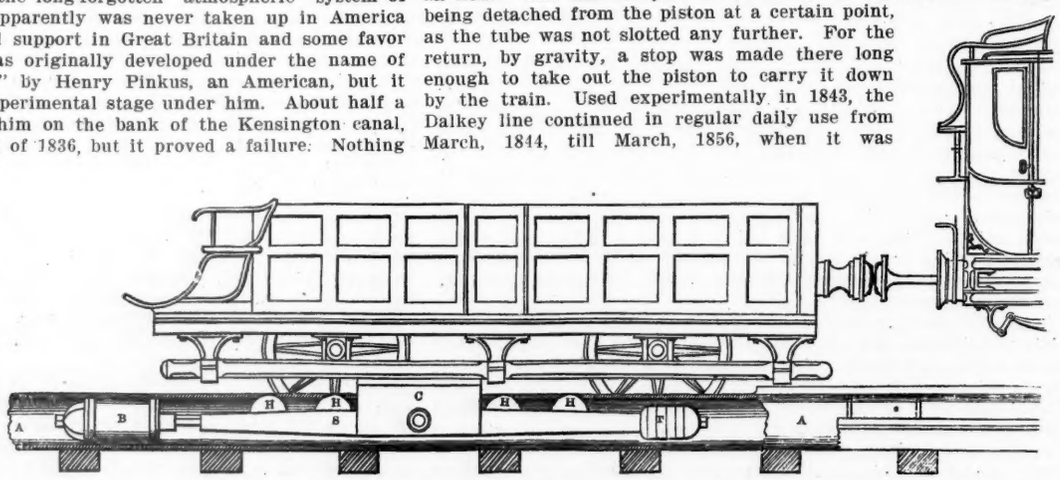
One of the most interesting chapters in British railroad history is that connected with the long-forgotten "atmospheric" system of traction. The scheme apparently was never taken up in America but it obtained powerful support in Great Britain and some favor on the continent. It was originally developed under the name of the "pneumatic railway" by Henry Pinkus, an American, but it never got beyond the experimental stage under him. About half a mile of it was laid by him on the bank of the Kensington canal, near London, at the end of 1836, but it proved a failure. Nothing daunted, Messrs. Clegg and Samuda introduced the improvements under which the "atmospheric" system, as they called it, undoubtedly proved that it amounted to something. Trains were to be worked by a piston "B" covered with leather, shown in one of the drawings published herewith, which was moved along in a tube or pipe "A" by exhausting the air in front of it. As carried out in practice, this tube, generally of 15-in. inside diameter, consisted of a series of iron castings, fitted into each other and having projecting brackets or feet through which they were attached to the sleepers midway between the rails. On top of the pipe was a narrow continuous slot for the passage of a plate of iron "C" called the "coulter," which connected the piston with the leading or motor vehicle of the train. To get a vacuum, however, with an open pipe would be impossible, therefore along the slot lay, in a recess or groove cast on the top of the pipes, a belt "G" of well-greased leather. This was fastened down at one side and free at the other. It fitted close and made it possible to get a considerable degree of exhaustion by means of air-pumps worked by steam engines about every three miles. The piston in the tube had a rod "S" projecting behind it, fitted with four small vertical wheels, "H H H H."

Two of these wheels lifted up slightly the greased valve or belt in front of the arm connecting with the coach and two raised it behind, so that the weight of the atmosphere rushing in might drive the piston against the small resistance on the other side. Directly the second pair of wheels had passed under the valve a special vehicle followed carrying a long flat case "N" containing burning charcoal. This case ran in the trench or groove and sealed the valve up air-tight by melting a greasy composition "F" placed along the edge opposite to the hinge or attachment of the valve. There was a wheel "R" at each end of the heater, either of which could be used, according to the direction in which the train was travelling, for lightly pressing down the valve preparatory to sealing. The heater, of course, could be raised up when the train was standing, or it would have burnt the valve. Iron bands were rivetted to the long valve or belt on both sides to strengthen it and prevent it from getting sucked into the tube.

Such was the method under which the "atmospheric" system attained a certain degree of success and excited hopes and expectations much beyond what its performances ever justified. The absence of smoke and ashes, the saving in strength of rails and substructures and the quietness of action were thought to be immense advantages. Few, however, foresaw what railroad traffic would become, and these advantages proved to be purchased much too dearly.

The first practical trials took place on Wormwood Scrubbs on June 11, 1840, where half a mile of single line, with a 9-in. pipe, was put down on the course of the present West London Railway. That line was then unfinished and at a standstill for want of money. Messrs. Clegg and Samuda, well-known engineers, laid and worked this experimental line at their own cost. It was a temporary affair, laid roughly, and rose at the rate of about 1 ft. in 115. An engine pumped up a sufficient vacuum (23½ in.) to run a light coach or two at the rate of 30 miles an hour up-hill. The side of the pipes was coated with tallow to reduce the friction of the piston. A valve in the piston could be opened by the motorman, so that the vacuum, being temporarily destroyed, would not hinder the stopping of the train. Brakes, of course, were also used. On June 29, 1840, the trials were witnessed by the Prince Consort, who took much interest in inventions. In 1843 the apparatus was removed as the road was about to be in operation with steam locomotives.

The system was tried soon after in Ireland by the same patentees on an extension 1¾ miles long of the Dublin & Kingstown Railway to Dalkey. Here the tube was 15 in. in diameter and the pumping engine of 180 instead of 16 h.p. The line rose part of the way as steeply as 1 in 57 and was much curved instead of being straight. Loads of as much as 60 or 70 tons could be taken up at about 18 miles an hour when the plant was new, and it could always whisk up a little train of 15 or 20 tons at 40 or 50 miles an hour. The last 560 yds. were run up by impetus, the carriage being detached from the piston at a certain point, as the tube was not slotted any further. For the return, by gravity, a stop was made there long enough to take out the piston to carry it down by the train. Used experimentally in 1843, the Dalkey line continued in regular daily use from March, 1844, till March, 1856, when it was closed to be converted to steam traction and extended to Bray. Both Brunel and Robert Stephenson, besides a commissioner from the French Government, had trials made on this line, though they came to by no means the same conclusions about its suitability for general traffic.



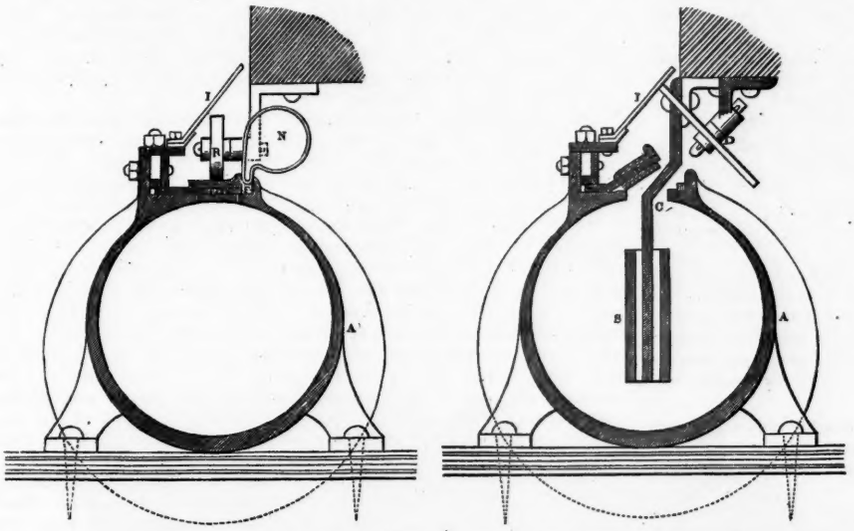
Atmospheric Railroad and Carriage, Showing Vacuum Tube and Piston.

The next bit of "atmospheric" was on the London & Croydon Railway, which laid a single line of it, as an addition, between New Cross and the terminus now called West Croydon. It was principally worked in 1845-7 between Forest Hill and Croydon and was fairly successful, mechanically, at first. Light trains were said to have been taken at tremendous speeds, vacuum being produced by pumping engines totalling 300 h.p. at two different places. A long incline had to be surmounted to get over the Brighton Railway. This soon proved too much for the apparatus when it got a little worn, the power used gradually to die away, and the affair got to be known as "the fainting lady." In 1846, when the Brighton and Croydon companies united under the title of the London, Brighton & South Coast the predominant partner put "the fainting lady" out of her misery. Uniformity of system was, of course, necessary.

The new system was somewhat hastily applied on the South Devon Railway, a 7-ft. or "broad" gage line intended to connect Exeter and Plymouth. It was built only from Exeter to Newton Abbot, 20 miles of level line, where atmospheric traction was in use for about a year from September, 1847. The line, like the others, had 15-in. pipes, but 22-in. tubes were to be used for the heavy gradients which extend westward from Newton Abbot. Al-

though begun, that part never finished on the atmospheric system, which was given up on the alarming discovery that the working expenses of the road were more than the receipts. This was chiefly due to a small traffic. The pumping engines had to be in steam ready to work at any moment; consequently they had little to do, while two or three locomotives could have handled all the traffic and been profitably employed.

In France, where the atmospheric system excited the greatest interest in scientific circles, it was in use from 1847 till 1860 between Le Pecq and Saint Germain, forming an extension, about 1¼ miles long, of a branch of the Chemin de Fer de l'Ouest from Paris to Saint Germain. The line rose 1 in 28½ to the terminus. The piston was taken out at the top and carried down by the train, the plant being built on Clegg & Samuda's system. It was given up finally because the growth of the traffic required the trains to be run through to Saint Germain, the apparatus being only powerful enough to work a very light train, into which passengers changed at Le Pecq. In fact, trains often had to be worked through by a locomotive.



Sections Through Vacuum Tube With Valve Open and Closed.

There was always difficulty in keeping the long valve sufficiently air-tight, nor would it stand the rapid lifting up and closing down. To get a sealing composition adapted to a changeable climate proved, also, troublesome. Many mixtures were tried but in hot weather they were likely to melt and get sucked into the pipe, while during frost it was not always softened enough by the rapid passage of the heater, an instrument which was dispensed with in very warm weather. In spite of a series of hinged iron lids "I" placed over the valve and raised by a special wheel "D" fitted diagonally on the first vehicle, rain and snow sometimes got into the pipe. On the South Devon line, which runs close to the sea for miles, the salt spray proved extremely injurious, rusting the iron and hardening and rotting the leather. No doubt improvements would have been made, and for a short, quick to and fro service of extremely light trains the system was fairly well suited, but for general railroad work its lack of adaptability was painfully conspicuous, while the power obtainable was much too small.

Foreign Railroad Notes.

In Japan the railroad from Osaka to Vakayama, 40 miles, is to be worked by electricity instead of steam as heretofore.

The Russian government has agreed with the Chinese Eastern Railroad Company that the latter shall work the Ussuri Railroad, built as the eastern section of the Siberian Railroad, until 1931.

The grain rates on the Russian railroad were to be increased January 1 by about 9 per cent., except shipments to Black Sea and Baltic ports and to the junctions with foreign railroads on the western border (substantially shipments for export), for which the rates are raised very little for short distances and about 8 per cent. for distances greater than 360 miles.

The German Dining Car Company at the end of its fiscal year, Sept. 30 last, had 56 dining cars and contracts with railroads for running such cars on 60 trains. It paid for the privilege of attaching its cars to trains an amount equal to 7¼ per cent. on its capital. Its net earnings were at the rate of $2,632 per car, which is three times as much as the dividend of 10 per cent. paid on its capital of $476,000. The capital indicates that its cars have cost less than $8,500 each.

The International Sleeping Car Company, which has its chief office in Brussels, is to increase its capital from 50,000,000 to 62,500,000 francs. The company has increased the number of its cars from 726 to 1,026 within the last five years.

Train Accidents in the United States in December.[1]

*†rc, 1st, Rutland Railroad, Vergennes, Vt., a gravel train ran into the rear of a preceding mixed train, wrecking the two passenger cars at the rear of the leading train, which took fire and were partly burned up. Three passengers were killed and 30 injured. The gravel train had become uncontrollable by reason of the failure of the air-brakes, due, it is said, to the closing of an angle cock by being struck by a piece of ballast.

unf, 1st, 10 p.m., Baltimore & Ohio, Guffy, Pa., a passenger train was derailed while running at full speed, and the engine and baggage car fell down a bank. The engineman was killed and the fireman and baggage man injured. It is said that the derailment was due to a misplaced switch.

xc, 2d, Chicago Great Western, Maple Grove, Iowa, collision between a freight train and a work train, wrecking both engines and several cars; one trespasser was killed.

xc, 3d, 4 a.m., Southern Railway, Suggsville, Ala., a freight train ran into the rear of a work train, wrecking the caboose; the conductor, engineman and flagman of the work train, who were asleep in the caboose, were injured, two of them probably fatally. The work train was standing on a side track where it had been all night, and the collision is said to have been due to the misplacement of a switch.

unx, 3d, Aberdeen & Asheboro, Troy, N. C., a special train carrying a circus was derailed and one car was overturned; one of the circus men was killed and two others injured.

bc, 4th, Chesapeake & Ohio, Mount Sterling, Ky., butting collision of freight trains; one fireman killed, three trainmen injured. The collision is said to have been due to a mistake in copying orders.

dr, 5th, Chicago, Indianapolis & Louisville, Frankfort, Ind., a passenger train was derailed by a broken rail and four passenger cars were ditched; 47 passengers were injured, but only two seriously.

dn, 5th, 4 a.m., Central of Georgia, Raymond, Ga., a freight train was derailed at a misplaced switch and the engine and six cars were ditched; the engineman was killed and the fireman injured.

rc, 6th, Chicago, Burlington & Quincy, Maquon, Ill., rear collision of freight trains; one engineman killed, one fireman injured.

bc, 6th, Maine Central, Annabessacook, Me., butting collision of freight trains, wrecking both engines and eight cars; four trainmen were killed and three injured. The collision was due to misreading of time-table by the conductor of an extra train.

xc, 6th, New York, New Haven & Hartford, Meriden, Conn., collision between a freight train and a switching engine; one trainman killed.

xc, 6th, Boston & Maine, East Rochester, N. H., collision of freight trains; engineman and one brakeman killed.

unx, 6th, Michigan Central, Otter Lake, Mich., a passenger train was derailed and three passenger cars were ditched; 20 persons were injured, three of them seriously.

[1]Accidents in which injuries are few or slight and the money loss is apparently small, will, as a rule, be omitted from this list. The official accident record, published by the Interstate Commerce Commission quarterly, is regularly reprinted in the *Railroad Gazette*. The classification of the accidents in the present list is indicated by the use of the following

ABBREVIATIONS.

rc	Rear collisions.
bc	Butting collisions.
xc	Miscellaneous collisions.
dr	Derailments: defects of roadway.
eq	Derailments: defects of equipment.
dn	Derailments: negligence in operating.
unf	Derailments: unforeseen obstruction.
unx	Derailments; unexplained.
o	Miscellaneous accidents.

An asterisk at the beginning of a paragraph indicates a wreck wholly or partly destroyed by fire: a dagger indicates an accident causing the death of one or more passengers.

*rc, 8th, Southern Railway, Danville, Va., northbound freight train, standing in the yard, was run into at the rear by a following passenger train (No. 34), and the caboose and several freight cars were wrecked. The wreck took fire and was partly burned up. The engineman of the passenger train was scalded to death and a brakeman of the freight injured. Three other persons were injured. The passenger had received a clear block signal before the freight train had cleared the block, and the flagman had failed to go out and protect the freight train after being told by the conductor to do so.

xc, 9th, Pittsburg, Kan., a passenger train of the Missouri Pacific ran into a freight of the St. Louis & San Francisco, at the crossing of the two roads, while moving at high speed, and wrecked several freight cars. The passenger fireman was killed and the engineman and one passenger were injured.

rc, 10th, 2 a.m., Illinois Central, Paducah, Ky., a northbound passenger train approaching the station at uncontrollable speed, due, it is said, to failure of air-brakes, collided with an empty engine which was to take this train over the next division. Three passengers and two trainmen were injured.

rc, 11th, Cincinnati, Hamilton & Dayton, Lima, Ohio, a passenger train ran over a misplaced switch and into the rear of a freight train standing on a side track, making a bad wreck. The fireman was killed and three other trainmen were injured.

unx, 11th, St. Louis, Iron Mountain & Southern, Batesville, Ark., a passenger train was derailed on a sharp curve and one passenger car and a refrigerator car fell down a bank. It is said that the passenger car rolled over three times, the bank being 50 ft. high. Of the 15 passengers in the car all were injured, two probably fatally.

unx, 12th, Atchison, Topeka & Santa Fe, Seward, Okla., a passenger train was derailed and the first four cars were ditched. The train was running slowly and only one passenger is reported injured.

unx, 12th, 8 p.m., St. Louis, Iron Mountain & Southern, Neelysville, Mo., passenger train No. 1 was derailed, and two coaches, one sleeper and a private car, were ditched. Ten passengers and two trainmen were injured.

rc, 13th, New York, Chicago & St. Louis, Mentor, Ohio, a freight train ran into the rear of a preceding passenger train; two trainmen were killed and 12 passengers were injured. There was a dense fog at the time.

rc, 13th, Illinois Central, New Orleans, La., a pay car train ran into the rear of a preceding freight train, wrecking the engine and several cars. The engineman was killed and the fireman fatally injured. There was a dense fog at the time.

bc, 15th, Texas & Pacific, Donaldsonville, La., butting collision of freight trains; four trainmen killed and two injured.

xc, 16th, 10 p.m., Pennsylvania, Canton, Ohio, an eastbound express train ran into a freight of the Wheeling & Lake Erie at the crossing of the two roads, and both engines and one mail car and one smoking car were badly damaged. The engineman and fireman of the freight were fatally injured.

dn, 16th, 9 p.m., Texas & Pacific, Waterford, La., a passenger train was derailed at a misplaced switch and overturned; fireman killed; engineman and two trainmen injured.

rc, 17th, St. Louis, Iron Mountain & Southern, Bald Knob, Ark., a slow freight train was run into by a following fast freight, and the engine, caboose and one car damaged. The conductor and one trainman were killed, and two trainmen were injured.

*xc, 17th, New York Central & Hudson River, Palmyra, N. Y., a freight train on track No. 3, standing at a water tank, was run into at the rear by a following freight, derailing the caboose and one freight car, which fell on track No. 2. Passenger train No. 57, on this track, approaching just at that moment, was derailed and its two engines were overturned. One engineman was fatally injured. The caboose of the wrecked freight train took fire and four passenger cars, two baggage cars and some of the freight cars were quickly burned up.

xc, 17th, Atlantic Coast Line, High Springs, Fla., a freight train collided with some freight cars; three trainmen killed and one injured.

dr, 17th, Southern Railway, Viley's, Ky., a mixed train was derailed by spreading of rails, and one passenger car was overturned and fell down a bank. Five passengers and one trainman were injured.

rc, 18th, Cleveland, Cincinnati, Chicago & St. Louis, Crossville, Ill., rear collision of freight trains; one trainman killed and one injured.

bc, 18th, 3 a.m., Houston & Texas Central, Thornton, Tex., passenger train No. 5 ran over a misplaced switch and into the head of a freight train standing on side track, wrecking both engines and several cars. Five trainmen and two passengers were injured.

bc, 18th, Vandalia road, Bushrod, Ind., butting collision of engines; one brakeman killed; three other trainmen injured.

bc, 18th, Atlantic Coast Line, Jacksonville, Fla., butting collision between northbound passenger train No. 82 and a southbound freight; one man killed; three injured.

unf, 19th, Yazoo & Mississippi Valley, Southwood, La., a passenger train was derailed by running over a cow, and the engine was overturned. The engineman and fireman were killed.

unx, 19th, Chicago, Rock Island & Pacific, Cullison, Kan., passenger train No. 30 was derailed and several cars were overturned; 12 persons were injured.

xc, 20th, Wabash road, Stonington, Ill., an empty engine ran into a work train, damaging several cars. Twenty-five employees were injured, eight seriously and one fatally.

unx, 20th, 11 p.m., Rutland road, Shelburne, Vt., an express train was derailed and several passengers slightly injured.

bc, 21st, Great Northern, Hillyard, Wash., butting collision between an empty engine and a freight train. Three employees killed. The engineman of the empty engine had no conductor, and started from the station in violation of rules, and without a clearance card.

eq, 21st, 10 p.m., Boston & Albany, Allston, Mass., an express train consisting of two engines and eight cars was derailed, while running at high speed, by the breaking of a parallel rod of the second engine; but, according to the reports, one brakeman was the only person seriously injured. The leading engine was the only part of the train not derailed.

bc, 22d, Southern Pacific, Harney, Nev., a freight train standing at the station was run into by a passenger train from the opposite direction, and 20 passengers were injured. The freight conductor was in the station, to ask for more time, and the engineman is said to have failed to clear the main track because his watch had stopped.

*†xc, 23d, 2 a.m., Minneapolis, St. Paul & Sault Ste. Marie, Enderlin, N. Dak., an eastbound passenger train, about two hours late, collided with a switching engine at the entrance to the yard, and both of the engines and several passenger cars were wrecked, and some of the cars fell down a bank. Two dead cars were overturned and the wreck took fire from coals in the stoves in the cars. The train was well filled, and nine passengers (all in the smoking car) were killed and 33 were injured, two of them fatally. The smoking car was crushed by the baggage car, which was pushed backward and upward and then fell through the roof of the passenger car. The switching train was on the main track in violation of rules.

bc, 24th, Buffalo, Rochester & Pittsburg, Eagle, N. Y., butting collision between passenger train No. 2 and an empty engine, wrecking both engines and the first two cars of the passenger train. Two trainmen killed and two injured.

*rc, 25th, Philadelphia, Baltimore & Washington, Wilmington, Del., a passenger train ran into the rear of a preceding freight train, and the passenger fireman, who jumped off, was injured. The caboose and three cars of the freight train were wrecked and took fire, and, with a quantity of lumber in a lumber yard near the road, were burned up. It is said that a block signal man had given a false clear signal.

xc, 25th, Rio Grande Western, Mounds, Utah, passenger train No. 3 collided with a freight engine standing on a side track; three trainmen killed.

dn, 25th, Southern Railway, Moncrief, Fla., passenger train No. 3 was derailed at a derailing switch and the engine was overturned. The fireman was killed and the engineman scalded.

bc, 26th, Cleveland, Cincinnati, Chicago & St. Louis, Brookville, Ind., butting collision of freight trains. A man riding on one of the engines was killed and two other men were injured, one of them fatally.

dr, 27th, Gulf, Colorado & Santa Fe, Somerville, Tex., a passenger train was derailed at a defective switch, and the engine and first two cars were overturned. The engineman and fireman were fatally injured.

†xc, 28th, Northern Pacific, Detroit, Minn., an empty engine ran into the rear of a stock train, which had been stopped on account of a hot journal. Five men sleeping in the caboose were killed.

xc, 29th, Seaboard Air Line, Peachland, N. C., passenger train No. 32 collided with a string of freight cars, making a bad wreck. The engineman was burned to death.

†rc, 30th, 7 p.m., Baltimore & Ohio, Terra Cotta, D. C., eastbound local passenger train No. 66, just starting from the station, was run into at the rear by a train consisting of an engine and eight passenger cars, and all of the three cars of No. 66 were wrecked. Forty-three persons were killed and 67 injured. The victims included some who were standing in the station platform. The empty train appears to have been running at uncontrolled speed under a permissive block signal. The engineman of this train had been on duty long hours without rest. There was a dense fog at the time. This accident was reported in the *Railroad Gazette* of January 4, 11 and 18.

bc, 30th, 11 p.m., Vandalia, Indianapolis, Ind., butting collision of locomotives running slowly in the yard. One fireman was killed.

eq, 30th, Southern Railway, Chatham, Va., a freight train was derailed at a curve by the breaking of the flange of a wheel, and eight cars were wrecked. Two men were killed and two injured.

Four-Cylinder Compound Locomotive for the Italian State Railroads.

There was exhibited at the recent Milan Exposition, a locomotive built for the Italian State Railroads that possesses so many variations from standard practice that it may fairly be classed as an experiment. The machine was built by the Societá Italiana Ernesto Breda, Milan, and is one of the most powerful locomotives built, up to this time, for the state system. It is intended for service in express passenger work between Milan and Venice. It is a four-cylinder compound, with six wheels coupled, and, as will be seen from the reproduction of the photograph, is designed to run normally with the cab to the front. The four-wheeled bogie truck is set beneath the rear end of the boiler, and has a wheel base of 7 ft. 8½ in. A peculiarity of this truck is that the center plate is not situated midway between the wheels, but the space is so divided that the distance from the outer wheel to the center plate is 49.2 in. and 43.3 in. to the wheel beneath the throat. As the driving wheels are 75.59 in. in diameter the rigid wheel base is carried out nearly to the end of the smokebox, making it necessary to set the cylinders well out to the rear beyond the smokebox, and to carry them on an extension to the frames. The arrangement of these cylinders is even more novel than their location and general appearance. Instead of the usual arrangement of placing the high-pressure cylinders outside the frames and the low-pressure between them, or *vice versa*, the two high-pressure cylinders are placed on one side and the two low-pressure on the other side of the engine, one of each being outside and the other between the frames. These two sets of cylinders are each cast in one piece together with their common steam chest, forming an exceedingly complicated casting. They are bolted together along the center line, the low-pressure cylinders being upon the left-hand side. The arrangement of cranks on the two sides of the engine follows the usual practice in that they are set 180 deg. from each other and 90 deg. from those on the opposite side. This makes it possible to use a single distribution gear for each set, or two for the engine, in accordance with the usual practice. At the same time it will be noted that, with this arrangement, the actual starting will usually be done with either the high or low-pressure cylinders, while the others may be exerting no turning moment at all. For example, if both high-pressure cranks are on the centers, the starting must be done by the live steam admitted to the low-pressure cylinders, the whole work being done upon one side of the engine. The moment the engine has passed the center, however, the other set comes into action. This is merely an extension of the conditions that exist with the two-cylinder compound to the working of the four-cylinder, and is unusual.

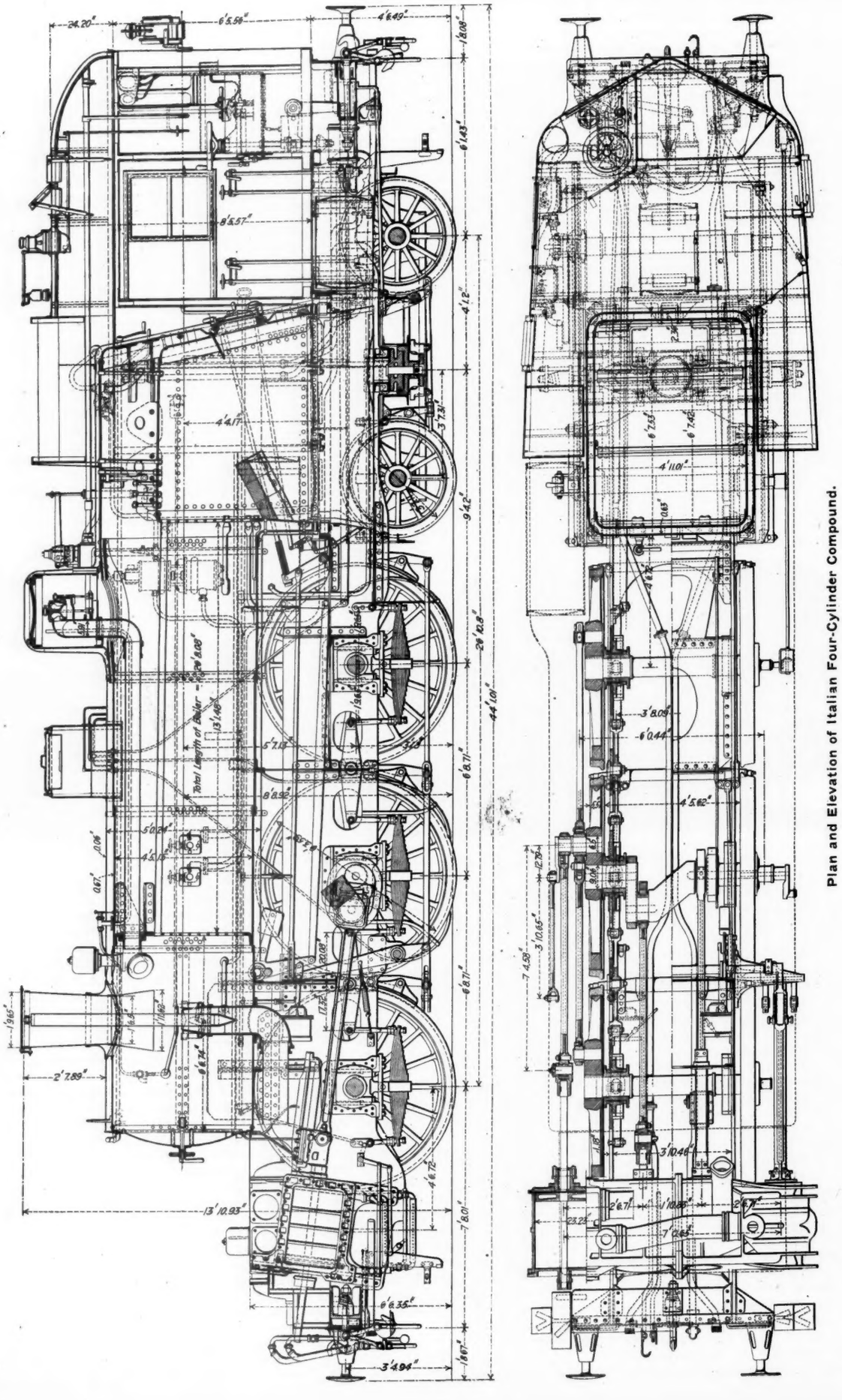
Four Cylinder Compound for Italian State Railroads. Normal Position of Engine and Tender.

In order to clear the forward driving axle with the cross-heads and guides of the inside cylinders, the latter are raised and inclined downward toward the wheels. It is thus brought about that one high and one low-pressure cylinder are horizontal while the other two are inclined.

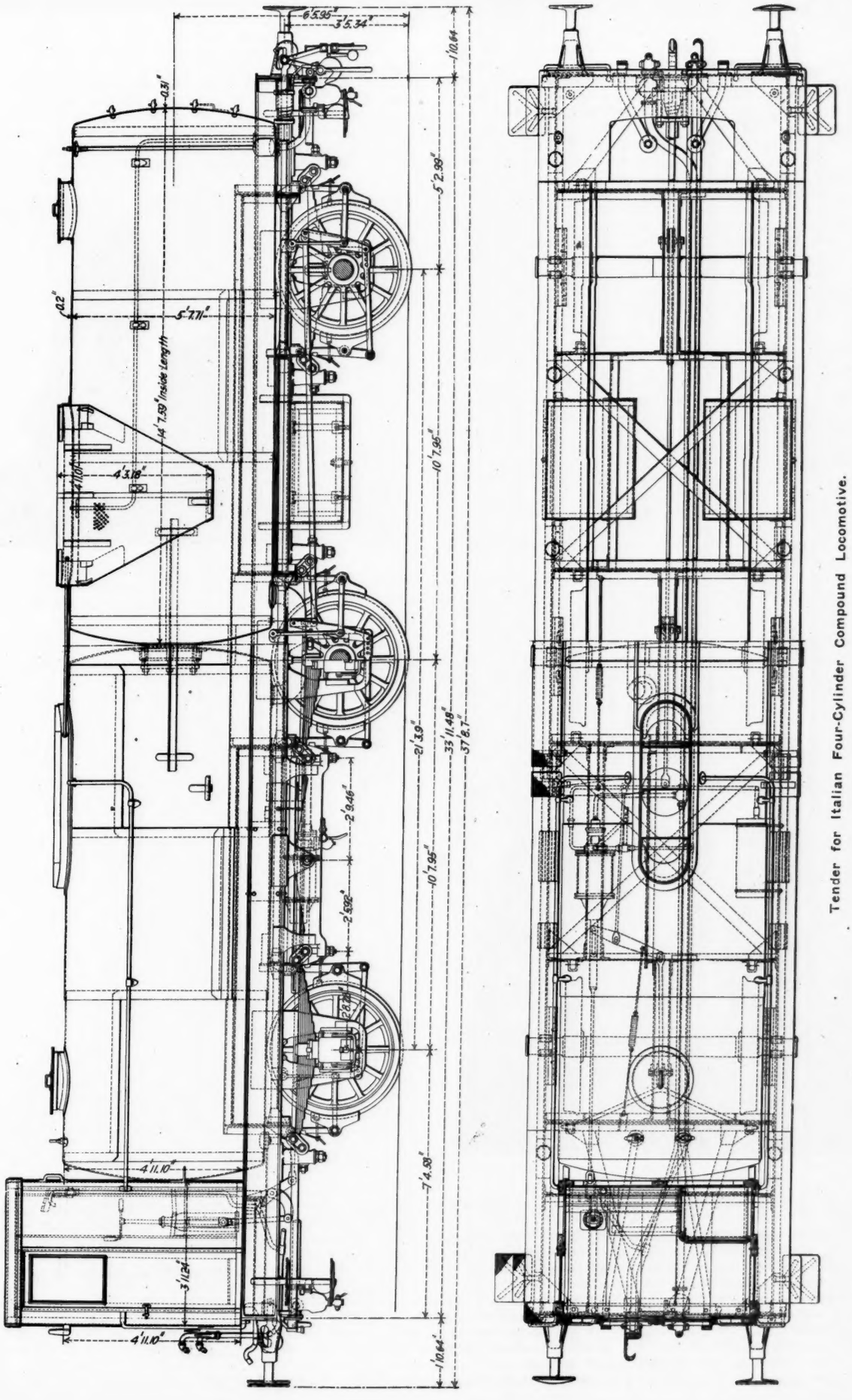
The four connecting rods drive the same axle, which is the middle one. This crank axle, whose general appearance is shown by the engraving, is of nickel steel made by Krupp, and contains between 5 and 6 per cent. of nickel. It is forged solid with the crankpins bored hollow with a 2¾ in. hole that extends back to the bend for the diagonal connection. This part is rectangular, with a thickness of 7⅞ in. and a depth of 10¼ in. The disc, uniting the crankpin portion to the journal, is strengthened by having a heavy steel band shrunk upon the outside. The valve gear is of the Walschaert type and is driven from the outside crankpins and crossheads. The reversing mechanism will seem rather complicated to an American and can best be understood by following out the lines of connection on the engraving. This shows that the reversing lever is replaced by the vertical screw and shaft with a horizontal wheel, operating a block sliding in the jaws of a bell crank, from the vertical arm of which a connection leads forward to an intermediate lever suspended beneath the boiler, by which the motion is somewhat reduced, and is thence carried by another connection on to the arm of the lifting shaft. The radius bar and its hanger are counterbalanced by a weight. The valve is of the piston type and works in a steam chest that is above and parallel to the outside cylinder. The valve itself can be made simpler than that commonly used with four-cylinder compounds in that it does not have to provide for the distribution of the high-pressure exhaust to the low-pressure cylinder and the final exhaust from the latter; for it has only to admit steam to the set of cylinders to which it is attached and exhaust the same when it has done its work. The ports leading to the two cylinders may have the same opening into the steam chest but cross in the casting, which makes it a complicated one to make, as already stated, but simplifies the valve construction and operation proportionately.

Steam is taken into the dry-pipe at the dome through a Zara throttle valve which has already been described in the *Railroad Gazette* of December 21, 1906. This is a balanced throttle in which the use of a double seated valve is avoided and the balance obtained by a piston at the lower end. In this case it possesses a further modification by which steam is admitted to the receiver between the two sets of cylinders, whence it flows to the low-pressure steam chest and serves to start the engine. As the valve starts to open, a small valve at the side, controlled by a separate arm on the throttle rod, is opened and admits steam to the receiver. After the engine is under way, and the throttle is opened more, this passage port to the receiver is closed by the further movement of its valve and the engine is put into compound action. The general appearance is shown by the photograph of the apparatus as set up for demonstration. The dry pipe runs to the front tubesheet and then, at the T head, turns to the left, and drops down through the smokebox to connect beneath it with the flange of the high-pressure steam chest at the point shown on the plan.

The steam after having done its work is exhausted into a pipe 9⅞ in. in diameter, that occupies the same position and reminds one very much of the pipe leading from the low-pressure cylinder back to the smokebox in the Mallet compound built for the Great Northern Railway, and illustrated in the *Railroad Gazette* of Oct. 12, 1906. In each case, an expansion joint has to be inserted. The single exhaust pipe of this engine finally terminates in a variable nozzle of the annular type that can be operated from the cab by the rod that is shown extending along the side of the boiler in the reproduction of the photograph; while the details of the mechanism can be followed out in the drawing. It consists simply of an arrangement of bell cranks and connections by which the two halves of the nozzle are turned back and forth on hinges by which the opening about the central pipe is made larger or smaller. This central pipe is suspended from above and ends in a cone at the bottom by which a core is cut out of the center of the exhaust jet. The central cone is no novelty, but the use of a pipe reaching to the top of the stack by which the steam is prevented from filling the hollow that has been formed will be new to most readers. The effect of this will undoubtedly be to give the exhaust jet a wider angle of divergence than it would otherwise have, while the presence of the pipe at the center will probably check the velocity of the blast, though this last effect will be hardly appreciable.



Plan and Elevation of Italian Four-Cylinder Compound.



Tender for Italian Four-Cylinder Compound Locomotive.

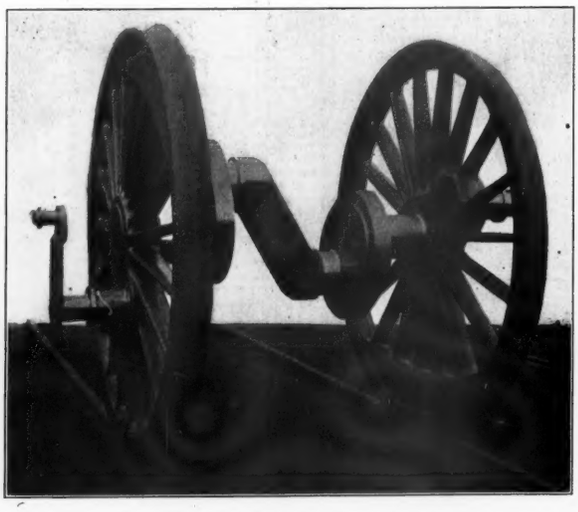
The stack offers no particular novelty other than the damper over the top, which is common European practice.

The spring suspension varies somewhat from American practice in the details of its arrangement. In the first place the three pairs of drivers are equalized, but the equalizing bars are so proportioned that only about 30 per cent. of the total weight on the drivers is carried by the main pair, while about 35 per cent. is carried by the front and back pair, each. This just reverses the usual custom in the United States; where, if any difference is made, the greater weight is put on the main pair of drivers. Nor is this all. The driving springs are underhung and have a camber away from the load. That is, the main plate is bent back and down so that it has passed the horizontal position. This is something that is almost never done, and every attempt is usually made to avoid this condition of spring action. Finally, the spring hangers are acting under compression, and these are comparatively small bars or bolts of about $1^3/_{16}$ in. diameter, with the whole thrust taken against the face of the nuts by which the length is adjusted.

The engine is fitted with the Westinghouse brake, with shoes on all wheels, worked by two cylinders, one on each side, and set well forward beneath the smokebox. A hand-brake of the screw type is also added, so that the driver brakes can be set in that way if it is desired; a condition that has not yet been provided for in similar service in this country.

The boiler is fitted with a copper firebox with side sheets held by stays of manganese bronze whose composition is 94 per cent. copper, 1 per cent. tin and 5 per cent. manganese. This produces a metal of about 43,000 lbs. tensile strength with an elongation of 30 per cent. The firebox roof-sheet and boiler shell are of iron, having a tensile strength of 53,000 lbs. and an elongation of 27 per cent. The tubes are of brass. A short brick arch carried on side brackets is used. At the door plates are inserted to protect the sheets from the shovel. For an engine of this length the tubes seem short; though, in reality, they are not particularly so, as they have a length of 13 ft. 1½ in. The water leg is very narrow, being but 2⅜ in. thick at the rear.

In the cab we find still more changes from the usual order. Like the American suburban engines that are intended for working in both directions without turning, this engine is provided with coal bunkers in the cab. These are placed on the right-hand side, one beside the firebox and the other at the end, as shown in the plan. The capacity of these bunkers is five tons. With such an arrangement it will be natural to expect that there will be a heavy load upon the right-hand side bearings of the truck when the engine is loaded, and that, if a variation is made in the strength of the springs to carry the loads imposed on the two sides, the engine will be thrown over to the left when it is empty. This is exactly what did happen in the case of some locomotives built for an American road

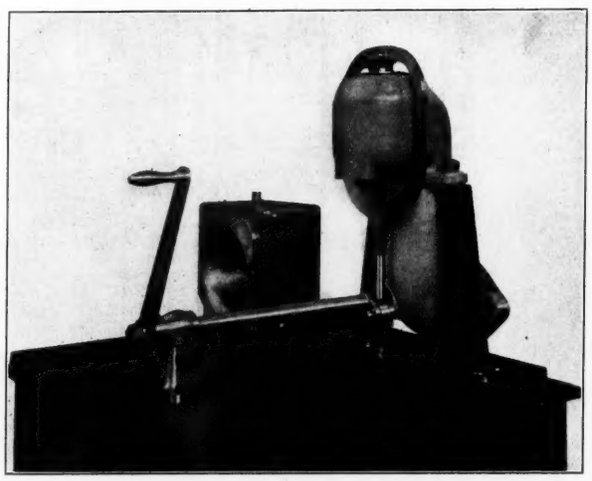


Crank Axle, Italian Locomotives.

a number of years ago when the coal bunker was placed on one side of the cab.

In the matter of cab and engine fittings the locomotive abounds in novelties, some of which would appear to American eyes to be decided inconveniences. Take the location of the operating parts in the front left-hand corner of the cab as an example. The throttle lever is suspended from the roof and swings across the cab. Back of this is the screw reversing wheel, and over behind it is the engineer's valve. It may be a mistake, but it seems difficult to imagine an arrangement that could be much unhandier and one in which speed of manipulation in case of an emergency would be much more hampered, to say nothing of the exceedingly cramped space that is apparently given to the engineman in which to do his work.

The tender is quite as novel in design as the locomotive itself, and it is difficult to account for some of the details on the ground of practical utility. In the first place it has a cylindrical tank, in which there is no novelty, but why the tender should have been provided with two tanks, placed end to end and connected by pipes at the bottom is difficult to understand. These tanks are each 5 ft. 7.7 in. in diameter and 14 ft. 7.6 in. long, and have a total combined capacity of 4,445 gals. At the top of each there is an oblong water hole, below which is a well of perforated metal so that the water



Zara Throttle Valve, Italian Locomotives.

entering the main body of these tanks is strained of its coarser impurities.

In addition to the two tanks the tender is also fitted with a brake van in which is the brake wheel by which the brakes may be applied. Shoes are set upon each side of each wheel by means of a hand-operated screw that must take some time in its manipulation. The shoes are interfulcrumbed, so that all are brought to a bearing at the same time. One of the features of the tender is the readiness with which it can be detached from one end of the engine and attached to the other, it being the intention to provide for running the locomotive with either end to the front, but with the tender always at the rear. The running gear also varies somewhat from the ordinary type found abroad in that the two pairs of wheels next the brake van are equalized, but with the equalization so proportioned that the greater weight is carried by the wheels at the end. Other than this, the spring suspension is typical of European practice, having the usual semi-elliptic springs over the journal boxes. Here attention may be called to the difference in the practice as shown on the engine and on the tender. On the latter the spring hangers are in tension and the set of the springs is against the load, while on the engine the reverse is the case, as already noted. The underframe is metal, with I-beam side sills, and the bracing follows the general lines of ordinary design.

In this engine we have another instance of radical departures from accepted practice, as so often occurs on European railroads, where the mechanical superintendent has a free hand to build what he chooses, and where it sometimes seems that he was bent on doing something different from his neighbor. That such an engine will work all right, there can be no doubt, but when looked at with an eye to accessibility of parts and convenience of handling it seems as though it left much to be desired. It is rarely that an engine appears that shows so much of originality of design and variation from current practice as this one. In fact, there is scarcely a point between the rail and the top of the stack that does not present some point of difference as compared with American practice, in addition to the points that have been touched upon. Such, for example, as the design of the truck, the shape of the cab, the rectangular sandbox, the safety valve on the dry pipe, the frames, the comparatively small diameter of the boiler shell, the high pressure, and, in fact, every detail entering into its construction, all of which makes it exceedingly interesting as a study of what is going on away from home.

The principal dimensions of the engine are as follows:

Cylinders, diameter, H. P.	14.17 in.
Cylinders, diameter, L. P.	23.22 "
Piston, stroke	23.63 "
Wheels, diameter, driving	75.59 "
Wheels, diameter, truck and tender	43.11 "
Wheel base of engine	26 ft. 11 "
Wheel base of engine and tender	65 " 7.6"
Boiler, length	26 " 8 "
" diameter of shell	4 " 5 "
" thickness of shell	0.66 "

Firebox, thickness of tube sheet	1.18 "
Heating surface	2,217 sq. ft.
Grate area	32.29"
Tubes, kind	Serve
" number	129
" diameter	2⅜ in.
" length	13 ft. 1½ "
Steam pressure	220 lbs.
Height of center of boiler above rail	8 ft. 8⅞ "
" " top of stack above rail	13 " 11 "
Frame, total length of engine	40 " 7 "
Engine, total length over buffers	44 " 1 "
Engine and tender, total length over buffers	81 " 9.7 "
Weight in working order	155,680 lbs.
" on driving wheels	95,400 "
" of engine and tender	237,450 "
Coal capacity	5 tons
Water capacity	4,445 gals.
Working speed	56 miles per hour
Tractive power	19,640 lbs.
Ratio of high to low pressure cylinders	1 to 2.68

$$\frac{\text{Weight on drivers}}{\text{Tractive power}} = 4.85$$

$$\frac{\text{Total weight}}{\text{Tractive power}} = 7.93$$

$$\frac{\text{Tractive power x diameter drivers}}{\text{Heating surface}} = 669.63$$

$$\text{Firebox heating surface} = 115.66 \text{ sq. ft.}$$

$$\frac{\text{Heating surface}}{\text{Grate area}} = 68.66$$

$$\frac{\text{Firebox heating surface}}{\text{Total heating surface}} = 0.052$$

$$\frac{\text{Weight on drivers}}{\text{Total heating surface}} = 43.03$$

$$\frac{\text{Total weight}}{\text{Total heating surface}} = 70.22$$

$$\text{Vol. 2 H. P. cylinders} = 4.30 \text{ cu. ft.}$$

$$\frac{\text{Total heating surface}}{\text{Vol. 2 H. P. cylinders}} = 515.58$$

$$\frac{\text{Grate area}}{\text{Vol. 2 H. P. cylinders}} = 7.5$$

The Protected Third-Rail on the Milan-Varese Railroad.

A recent bulletin of the Italian State Railways, summarized in *L'Ingegneria Italiana* of Nov. 16, offers interesting details of construction and expense of operation of this secondary line running from Milan to Porto Ceresio. The third rail used is of the regular State Railroad type, 39 ft. 4 in. long, weighing about 90 lbs. to the yard. A special steel a little softer than the average is used for these rails; its resistance is about 11 times that of copper. The rails are hard enough for use under wheels, however. The third rail is placed between the two tracks, being carried to the outside at switches and crossings. Its axis is 25⅝ in. from that of the nearer track-rail, and rises 7⅜ in. above it. At the joints, the third rail is provided with a fish-plate having two poles, and with the idea of further ensuring the continuity of the circuit there is set a copper connection with lugs. The supporting insulators are composed of a cast-iron tripod and a cap separated by an isolating cylinder of artificial granite. The cap is in direct contact with the third rail, and does not obstruct its longitudinal expansion, but prevents any lateral displacement by the interposition of a couple of cleats forming part of the cap itself. These insulators are attached to the ends of extra long ties, nearly five yards apart. Their insulating efficiency is so great that even after being soaked in water for over 100 hours they can resist a continuous current of 1,100 volts for six hours without any noticeable sparking or heating. To provide for lengthening due to changes of temperature, a space is left at intervals of 10 rails (131 yds.), and special flexible connections are used to maintain the circuit. At switches, grade crossings, etc., the circuit is closed by an underground copper cable, like those connecting the sub-stations with the conductor. At each break the third rail is bent downward, so that the connecting shoe will take it even at high speed without sensible shock. Every 1⅜ miles there are set along the line, in cast-iron boxes, knife section insulators, connected with the third rail by insulated cables. These are normally closed, dividing the conductor into so many sections; when opened, they make it possible to locate speedily any break or short circuit along the line. At the stations, and in general wherever employees or the public have to cross the tracks, the third rail is protected against contact by wooden planks which cover it above and at the side, and are supported by wooden stakes driven in the ground two meters apart. In connection with the station platforms, the protection is furnished by a corrugated iron strip set in the granite of the platform. The track rails are 10-13 yards long, weighing about 72 lbs. to the yard, with wooden ties, 17 to a 13-yd. rail. These rails are used for the return current, and are provided at the joints with copper connections. In addition, the two rails of one track, as well as the inner rails of double track, are joined every 100 meters by copper connections. The resistance of one kilometer (.62 miles) in operation is about 0.037 ohm; the loss due to insulation varies under normal conditions from 0.15 to 0.2 ampere per kilometer of third rail, according to the humidity. The total third rail mileage from Milan to Porto Ceresio is about 72 miles. The installation of the third rail cost about $493,600; the expense of operation has been as follows:

Year ended June 30:	Personnel.	Exp. material.	Total.
1903	$2,167.78	$2,858.52	$5,026.30
1904	2,154.46	2,773.22	4,927.68
1905	2,159.48	5,320.05	7,479.52

*From July 1 to June 30.

The Teredo in South Africa.

The ravages of the teredo have so serious an effect on wharf and pile maintenance cost, all along the South African coast, that the situation is comparable with that of our Gulf states and of southern California, varying with localities, as is the case in this country. It seemed desirable that a comparative study should be made of the methods used to meet the difficulty, and Mr. W. W. Hoy, General Manager of the Central South African Railways, has kindly collected for us the data printed below. Reports are given from the General Manager of the Cape Government Railways, the Director of the Portuguese system, and the Chief Engineers of the Central South African system and of the Durban Harbor Department, and an abstract of a paper by Mr. F. W. Waldron, Resident Engineer of the Mossel Bay Harbor Works, read before the Cape Society of Civil Engineers, is appended. It is fair to say that a complete resumé of the best foreign practice in dealing with the teredo is thus given:

LOURENCO MARQUES RAILROAD.

Lourenco Marques, Oct. 18, 1906.

In reply to your letter of even date and the copy of the Central South African Railway's General Manager's letter enclosed therein, regarding the depredations of the teredo to the timber used in the construction of the pier at this port, I beg to state that the timber used is, as you know, of the Australian jarrah, a sort of wood which resists pretty well the attack of that mollusc. The timber, which is already some four years old, is somewhat attacked by the teredo, especially between the lines of spring tides and leap tides. The holes, however, are not very deep at present. For the protection of timber from the teredo we have coated it with tincture "Sotor." This tincture is not, however, sufficiently lasting to convey a complete idea of its efficacy.

F. RAMOS COELHO,
Engineer-Director, Camino de Ferro de Lourenco Marques.

CAPE GOVERNMENT RAILWAYS.

Cape Town, Oct. 15, 1906.

With reference to your letter of the 17th ultimo, regarding the protection of wooden piles from the ravages of the teredo, I subjoin, for your information, copy of a report by the resident engineer in charge of construction, Buffalo river bridge, who has had some experience with timber piles:

"The device of a lock joint concrete pipe made in half sections, referred to by Mr. Price, has been tried in various countries with more or less success, and where no bracing or walling below water is required, it would be preferable to use these pipes in place of copper sheathing, provided that suitable material for their manufacture is to be obtained economically. A lock joint whole section pipe made of Monier concrete for slipping over piles is manufactured by Messrs. J. Wright & Sons, of Southcoast Junction, Natal, but I am not aware of the cost of the same."

T. S. M'EWEN,
General Manager.

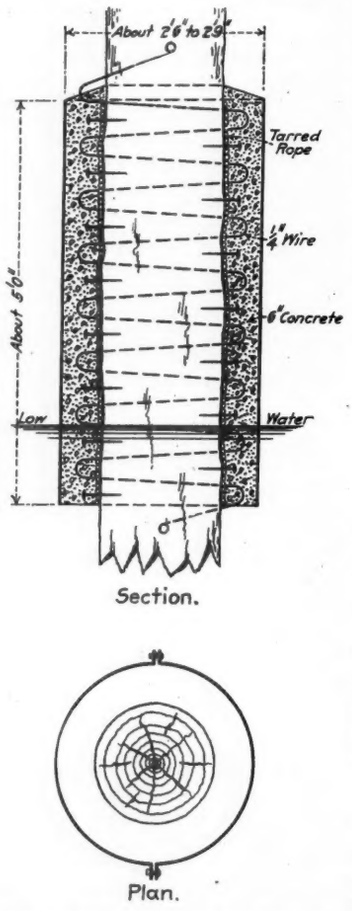
HARBOR DEPARTMENT, DURBAN.

Durban, Oct. 31, 1906.

Both the teredo and the limnoria are very destructive to timber in our bay, and for nearly 20 years past round jarrah has been used for piles for timber wharfage as being least liable to injury from these sources. Recently we have made use of turpentine (syncarpia laurifolia), which has worm resisting properties equal if not superior to jarrah. Our experience is, however, that no timber will withstand either of these destructive agents indefinitely, and therefore for a number of years past wooden structures have as far as possible been superseded by permanent concrete wharfage, of which we have now 6,835 ft. practically complete with depths from 23 to 34 ft. alongside. The readiness with which the teredo and the limnoria attack timber will be understood when I mention that in the case of blue gum piles of 18 in. diameter employed alternatively with jarrah wood piles for the timber wharfage at the bluff, a number of the former were practically eaten through in three or four years, and others have had to be, and are being,

renewed from time to time. These blue gum piles were grown in the colony and were not nearly so good for submarine work as imported jarrah or turpentine, though, of course, the latter are much more expensive. We have tried many experiments for making piles worm-proof, such as sheeting them with Muntz metal or copper but without any permanent success. Hewn or sawn timber is more readily attacked than round timber, and now we use nothing but round piles for this class of work, as it is considered that the astringent properties of the wood next to the bark, and the bark itself, act as a deterrent, and for bracings we use double-headed iron rails on account of hewn timber being a ready prey for the work.

As is well known to marine engineers the destructive effects of the teredo and limnoria on timber are chiefly experienced between low water and high water marks of ordinary spring tides. Some years ago I made an experiment of encasing a wooden pile in concrete for a few feet on either side of mean tide level to ascertain how far the ravages of these creatures might be checked by this means. The process was as follows: Around the pile to be protected tarred rope was wrapped to serve as a cushion against expansion. Over this and fastened from a point about a foot above high water mark, a spiral binding of fencing wire was loosely wound so as to leave 2 in. or 3 in. clearance between the spirals and the pile, the object of this being to reinforce the concrete casing. Over this the two semi-circular halves of a cylindrical shell or mould were placed and bolted together, the bottom being stopped up by means of canvas wound tightly over the lower end of the mould and round the pile. A mixture of ordinary concrete was then poured in and allowed to set for some days, after which the mould was detached and set aside. The accompanying section shows the work when finished. The result attained so far has answered my expectations and I see no reason why piles protected in this manner should not last for a number of years longer than in ordinary cases where the timber is continuously exposed to attack. My experiment was, however, confined to this instance alone, and as the pile selected was in a sheltered position under one of the timber jetties, I am unable to say whether the front piles of a structure protected on this principle would stand the direct shocks communicated by vessels moored alongside without breaking up the concrete casing. Some means of preventing this might if necessary be devised, but the inner piles would, of course, be in no danger.



Pile Protection by Concrete Sheathing, Durban, South Africa.

I should be glad to know the particulars and results of any experiments made at other ports for the prevention of injury to timber structures from causes similar to those dealt with in the foregoing remarks. —ACTING CHIEF ENGINEER.

CENTRAL SOUTH AFRICAN RAILWAYS.

September, 1906.

With reference to your letter of the 17th instant, I have only had occasion once to put in piles for a temporary bridge in sea water, on the east coast of India, and to protect the piles from the teredo navalis they were sheathed in copper. The same experience was met with in this method of construction, in that the copper was soon stripped when sinking the piles, and such portion of the plates as remained above sea level were soon stolen by the local boatmen. I had eventually to fill in the spot with dry stone rubble in order to carry the railroad across it.

Personally if I had anything to do with constructing a quay I should never dream of using any timber in it below sea water level, as I consider our knowledge of reinforced concrete is sufficiently advanced to enable satisfactory piles to be made of this substance which would resist any attacks, and if the locality did not suit these concrete piles, I should be inclined to sink a series of small walls to a satisfactory depth to form the face of the quay wall. —CHIEF ENGINEER.

CAPE SOCIETY OF CIVIL ENGINEERS.

Extract from paper entitled "The Destruction of Timber on the South African Coast by Marine Wood-borers," by Frank W. Waldron, A.M.I.C.E., member, Resident Engineer, Mossel Bay Harbor Works.

The distribution of the limnoria according to various authors is as follows:

Along the American coast from Florida to Nova Scotia, Long Island Sound, the coast of Massachusetts, the Bay of Fundy, the North Pacific coast, Puget Sound, the Straits of Fuca, upon the coast of Great Britain, and in other parts of Europe, they also exist around the South African coast more or less from East London to Robben Island, though the limnoria has not up to the present been seen at Mossel Bay.

As far as is known, no wood is proof against the marine wood-borers except sneezewood, but as this wood is scarce, and almost unprocurable in suitable sizes, its existence has to be disregarded in designing marine works of any magnitude.

A few piles of sneezewood were used at Port Alfred (Kowie river) in the construction of some groynes. These piles were removed after being down for over 40 years, and found quite intact and free from any kind of decay.

The following is a list of the various woods used on this coast, and observed by the author:

(1) Jarrah.
(2) Teak.
(3) Karri.
(4) Knysna iron wood.
(5) Knysna yellow wood.
(6) American elm.
(7) Pitch pine, and several kinds of deal.

Of all these woods, jarrah in an unprotected state gives the best results; an instance has, however, just come under observation, where the end of a 12 x 6 jarrah bracing was almost destroyed in 12 months.

At East London, jarrah piles 12 in. and 15 in. square were attacked by the teredo and limnoria.

The late Mr. G. F. Tippett, resident engineer to the East London harbor board, stated in a communication to the public works department: "That some of the jarrah in our wharves has stood fairly well, but some has been attacked by the teredo, also by the limnoria. That which was hard and would not float stood well, but that which was light and buoyant did not stand so well. Karri is sometimes substituted for jarrah."

Mr. Tippett gave the life of jarrah as piles at 15 years.

The wharves referred to have been down between nine and ten years, the piles of which are all cut die square.

The acting resident engineer, Durban harbor board, also says: "Round jarrah piles if cut at proper seasons and grown in the iron-stone districts could be depended upon to last for a long period. Some of the piles driven in an old wharf at the time of the Zulu war (22 years ago) are still in fair state of preservation; round piles have been used extensively in wharf construction here and we have always found it stand well, notwithstanding that the teredo and limnoria are very active in these waters. That used in form of square bracings was eaten clean away for about two and three feet between low and high water mark.

"Several kinds of timber from Australia have been tested from time to time, but none of these come up to sound jarrah, with the exception of syncarpia laurifolia, turpentine wood—which, after being under test for two years' immersion, shows no signs whatever of being attacked."

It will be seen by the preceding evidence that notwithstanding the durability of jarrah over other woods, under some conditions it succumbs to the wood-borer much earlier than is generally supposed, so that unless the timber has been grown in the proper soil and felled in the right season, there is little chance of it standing the effects of the worm for any considerable period.

Teak.—Twelve inches square used for piles at Port Alfred were soon destroyed; some of these in a jetty were completely eaten through between high and low water, with the combined work of the teredo and limnoria in 12 years.

Yellow Wood.—Unprotected has been used extensively for temporary piles; some of these have been nearly destroyed in three months; instances have, however, been known where they have lasted for more than a year.

Some creosoted fender piles in a jetty at Mossel Bay have been down for 12 years, are in fairly good state of preservation under

the water, but almost destroyed above water where subjected to much wear.

Knysna Iron Wood.—Unprotected does not appear to last much longer than yellow wood; some fender piles have been quite destroyed in three years.

Karri.—This timber though tough, heavy and close in grain, does not withstand the teredo well. In some piles used for staging, nearly two-thirds of the cross section has been bored in 12 months, the outside showing little evidence of the presence of the worm. At Robben Island some karri fenders 12 in. x 6 in. were destroyed to a depth of 1½ in. by the limnoria in five years, but only a few teredo workings were found in the same timber.

Pitch Pine, Oregon Pine and Memel.—Has been used for piles and framing, but none of these in an unprotected state will last long.

American Elm.—Although too expensive in this country for jetty or wharves, even if suitable, is used sometimes for framings of tugs, lighters, etc. Some time ago whilst a steam tug at Mossel Bay was undergoing repairs it was discovered that the keel was eaten by the teredo. A portion of the copper sheathing on it being chafed, exposed the wood, at which spot the worm attacked it, almost destroying the keel in a few months.

At Mossel Bay the teredo is practically active in all kinds of timber, more so, it is believed, than at any other place on the coast. The limnoria has, however, not been seen there.

Protective Measures.—Of the various means of protecting timber used in sea works against the wood-borers, none have so far been found altogether efficacious or reasonable in cost.

The methods of protection resorted to in this country are few, and they are as follows: Copper sheathing, creosoting, and the "teredo" or "worm nails" (such as used in Holland).

In weighing the merits of the above means of protection, it does not appear that the advantages are commensurate with the cost.

The copper sheathing of piles if properly done will cost from 4s. 6d. to 5s. per foot run of 12 in. x 12 in. timber, creosoting 2s., and teredo nails about 3s., in addition to the cost of the timber.

As already shown the copper sheathing, unless kept intact, which is most difficult, does not ensure the safety of the wood under it. Creosoting has also its disadvantages, inasmuch as the timber which takes creosote best is in nature light and soft grained, and will not bear heavy strains in structural features, whereas a heavy close grained wood does not absorb enough creosote to protect the timber for any length of time.

Teredo nails were used in a small number of piles at East London many years ago. The surface of the wood exposed to the attack of the teredo is covered with flat headed iron nails driven close; these nails on rusting formed an impervious coating. The system was, however, not continued for obvious reasons.

Various other methods of protection have been attempted in different countries, such as paints of verdigris, paraffin, asphalts, salts of mercury and of iron; cylinders of earthenware pipes slipped over the pile joined together, and the space between the pile and the cylinder filled with sand or cement have been used with a fair amount of success.

None of the methods of protection either external or internal have been altogether successful; the question therefore arises whether it is not better in the long run to use steel structures where the marine borers are active.

In ordinary jetties or wharves a steel girder 12 in. x 7 in. weighing 65 to 75 lbs. to the foot with a special cast-iron shoe, may be used for piles. It can be driven through any material into which timber is driven by an ordinary pile driver and a suitable dolly. Where solid rock is found the pile without the shoe can be dowelled into the same.

As regards the first cost of steel it should be very little more than timber, and in some localities less.

A 12-in. x 7-in. girder at 70 lbs. per foot being used in place of a 12-in. x 12-in. timber will cost from 5s. 6d. to 6s. 6d. per foot run. The walings and bracings may also be made from girders of various sections.

Regarding the protection of steel structures against rust, this may be effected by painting, or tarring the part above low water, but that below low water cannot be so treated; it is, however, found that the natural sea growth where not disturbed forms a coating in a very short time, which affords some protection from rust.

Discussion.

Mr. George Valder, representing the New South Wales Government, said that in Australia, New Zealand and South Africa, he had given attention to the question of timbers suitable for harbor work, and as far as his knowledge went no timber resisted the action of the teredo worm with the single exception of the turpentine tree (syncarpia laurifolia). In the paper just read Mr. Waldron referred to an experiment with a turpentine pile at Durban harbor; this was, he believed, the only trial of turpentine in South Africa, but he was pleased to be able to state that in this instance it had again proved a signal success. The engineer about two years ago had this pile raised; it had then been in the water a little over five and a half years, and although all the piles near it were badly damaged by the teredo and limnoria, this turpentine pile was as sound as the day it was put in. The engineer was so pleased with this result that he at once ordered 100 piles of from 50 to 55 ft. long. These had been used in connection with the Durban harbor works and a further large consignment had since been obtained.

Mr. Wynne-Roberts said that his experience fully bore out the remarks of Mr. Valder in the use of turpentine as the most successful timber to resist the teredo. He found the iron used in the bay for jetties was very liable to corrosion, and as an alternative to this or steel, he would like to see reinforced concrete employed, as at Southampton and at many places on the Continent and in the United States. With the use of reinforced concrete there was no danger from corrosion; the experiments at Liverpool showed that rusting from immersion in sea-water was negligible. He thought that the two points in favor in the use of reinforced concrete in the place of timber were (1) no painting required and (2) not attacked by the teredo or rust.

Mr. G. Lacy Good.—In 1882, when engineer-in-charge of harbor works investigations in the West Indies, for the late Sir John Coode, I found old jetties constructed of native white cedar, quite unscathed, and was informed that the teredo had never been known to attack this particular wood. But whole trees were used in these instances, stripped only of their bark; and I am of opinion that many other timbers might be found to resist worm action, were they not sawn up and the hearts thereby exposed.

As a further proof of this, during my experience in 1875-6 on the harbor works at the Isle of Man, where untrimmed piles of pitch pine over 50 ft. long, were used in the temporary stagings, there were never any signs of worm action.

Previous to the year 1882 it was believed amongst marine engineers at Westminster that green heart, though sawn up, was impervious to worm action. Mr. Good's researches, however, in the West Indies disproved this idea; for, as an instance, he found the Royal Engineers' Jetty at Barbadoes, which was constructed of that famous South American timber, had had to be sheathed with copper, owing to the inroads of the teredo. He remembers the agitation, caused by his report, in Sir John Coode's office, for at that time designs were being got out by Sir John for Table Bay harbor, in which the provision of green heart as fender piles to the Loch Jetty had been included.

Mr. Good's own experience of over 30 years agrees with Mr. Waldron's as to this worm action being greater in the warmer than in the colder seas, their action being more concentrated where the range of the tide is small, as in the case of Oceanic Islands, where the tidal wave does not exceed 2 ft. at full and change of the moon: the limit of destruction extending from a few feet below low water up to near high water mark.

The admixture of fresh water, as in the case of river estuaries, is usually discouraging to the teredo; but at Knysna harbor, South Africa, though there must be a considerable flow of fresh water over the surface of the salt, on the ebb tide, he found the results of worm action greater than he had observed elsewhere.

With regard to the question of the use of steel versus wood in the construction of marine works, no doubt, as Mr. Waldron says, in the long run steel structures would prove more economical than timber, but where funds were limited and timber plentiful, and the range of tide at the same time small, Mr. Good is of opinion that timber cased with Muntz metal at the water line should be used. The cost of the sheathing would not exceed £32 per bay or £2 15s. per foot run, in the case of a three-piled jetty, where the range of spring tides did not exceed 5 or 6 ft.

Scupper-nailing, as teredo or worm nailing is called in England, was a practice largely in use on the East Coast, and proved very effective in protecting the timber piers from destruction, as the large flat heads (about 1 in. in diameter) of the nails soon rusted together and formed a veritable coat of mail. He had seen this work done on a large scale at Great Yarmouth, and as this sort of work is relegated to the old men, who would otherwise have no employment, and are glad to earn a few shillings, the cost is not great. As, however, the heads of the nails are apt to spring off when the piles are being driven, it is not a practice Mr. Good can recommend. Creosoting, he has little faith in.

It is not generally known that some of the softer rocks are also subject to the boring propensities of certain denizens of the sea, but Mr. Good believes these do not come under the teredo classification but under that of the bivalve, these rock boring creatures being encased in long finger shaped shells. He came across an instance of rock thus acted upon when making an investigation at Kirkcaldy Harbor, N. B., where the argillaceous shale had been honeycombed by some marine creature, the perforations being as though cut by a drill, the foundations of the lock gates to the dock being thereby endangered.

Mr. R. Devenish-Meares.—The timber approach jetties at the entrance to the Kidderpore docks, Calcutta, were built of 14-in. sq. Greenheart piles in 1890. The writer had occasion to examine them

in the cold weather of 1900, and found many of them eaten away so completely as to reduce the area of the pile to, in cases, not more than 8 in. sq.; their ravages were worst between about 4 ft. above to 4 ft. below low water; below the lower level the timbers were practicaly intact. Perhaps the difference in the zone of depredation of the teredo between Table Bay and Calcutta may be accounted for by the difference in the nature of the bottom; that at Kidderpore was a fine silt, that at Table Bay, he believes, sand. The water at Table Bay he believes clear, that at Calcutta is of the consistency of pea soup for the greater part of the year. Not only the Greenheart piles, but also gate sill timbers and caisson timbers of teakwood were so badly eaten away within a period of nine years that gates and caissons had to be docked and new timbers put in.

It was found when the timbers were taken off that the teredo had actually attempted to eat into the steel plates, many holes being observed in these up to 1/64 in. deep and perhaps 1/8 in. in diameter.

As protection from further damage the new timbers were sheeted with Muntz metal.

Jetties built upwards of 40 years ago above Calcutta, at the various Ghâts, had their piles, in cases, sheeted with zinc. Any so sheeted were still perfectly good in 1900, so it was considered that to sheet all new piles and timbers below water was the best preservative that could be used.

Interurban Freight and Express.*

BY EDWARD C. SPRING,

General Superintendent, Dayton, Covington & Piqua Traction Company.

Recent legislation in many of the eastern states favorable to the handling of freight and express by electric lines has caused the managements of such roads as are affected to look into the feasibility of establishing a freight or express business on their lines. Hitherto trolley freight has received comparatively little attention in the East, and in other regions rather less than the attention given to it in the middle states. Massachusetts interurban companies have recently been given permission by the Railroad Commission to engage in the freight business. Similar action has been taken in favor of the interurban systems of New Jersey. Massachusetts legislation has established a liberal policy to permit street railways to carry freight in order to afford additional facilities for the transportation of merchandise and farm products, thus giving a decided boom to localities where steam railroad facilities are limited. Naturally eastern operators are looking to the interurban lines of the Middle West for a solution of this same problem, where freight and express services have been in operation for some time; but, as a matter of fact, the roads of the Middle West have not fully shown or satisfied themselves as to the best course to be followed in taking care of this new branch of service.

Opinion is divided among managers of electric roads as to whether it is more advantageous to handle merchandise at express or freight rates. Each manager has his own personal opinion and ideas, and in summing them up we cannot but see that each man's opinion is based upon peculiar circumstances affecting his own property. The steam roads of the country have the advantage over electric lines in this respect, as the conditions under which they operate are more generally similar.

Freight traffic on electric lines has not developed enough to differentiate between freight and express traffic. The word freight as applied to steam roads cannot, in its literal sense, be applied to electric lines at present. Freight business means handling freight in carload lots by trains. The number of roads in the country today equipped for such service with enough of track to make it profitable is quite small. Our power stations are not equipped for this extra heavy service, nor is our rolling stock sufficient, or the physical condition of our track in shape to stand the wear and tear of such service. In view of these facts, which are all well known to you, roads must confine themselves to light freight and express service, and it is useless for us to think of competing with steam roads in handling freight in carload lots at this time. Handling light freight and express has, however, been so successful that the question of handling carload lots is being seriously considered, and has been successfully accomplished by a few roads, but carload freightage over connecting lines is a problem yet to be worked out. A universal interchangeable freight traffic and the making of joint rates are two matters which the officials of the steam roads have, up to the present time, been reticent in entering into with the electric lines, although a few of the smaller steam roads have entered into traffic arrangements with some of the electric lines.

The number of advantages offered by electric lines in handling certain commodities is becoming more apparent every day, each road having its own particular line of goods from which it gets the greatest part of its revenue. The interurban lines running through a farming community should have ample equipment to handle all business offered it daily without difficulty. Motor cars should be so equipped that trailers could be handled without delay, because the handling of merchandise with trailers as much as possible holds down operating expenses. Each company should have several box-car trailers to take care of carload business in addition to the handling of local freight. In all cases we must offer the same inducements to the shippers as are prevalent on the steam roads. The interurban freight stations at Cincinnati, Ohio, and Indianapolis, Ind., afford two of the best object lessons in the handling of freight at large terminals.

I believe that there is great need of reform in the manner of handling this business in most of the companies through the Middle West. The jealousies which exist between the companies must be done away with, and the hearty co-operation of all roads to the one end of serving the best interests of the electric lines must be pre-eminent. The necessity of rebuilding the road to take care of this heavy traffic must be seriously considered. Above all things I would not for a moment encourage any road to go into the freight or express business to the detriment of its passenger service. The freight branch of the service has a wonderful future, but I do not believe that the day will ever come when freight earnings are greater than earnings from passenger traffic, until all the independent roads have consolidated, and are operating upon private right of way and with double track.

The road that serves the large manufacturing and commercial centers, where the consignee demands his goods at a given time, and whose business warrants his paying well for their prompt delivery, can do an express business, charging express rates, and make it profitable, but to engage in a freight business on freight rates under these conditions would be suicidal. On the other hand, on any road that operates through a farming district, and caters to the demand of the farmer, to whom time is a small consideration, an express service would be entirely out of the question, and only freight traffic with the lowest possible rates should be considered. The farmer has not yet fully realized the advantages of interurban facilities, and charges higher than the present steam road rates are severely questioned. The merchants in farming towns, knowing that the farmers will not pay anything extra for quick service, are equally unwilling to pay more than what the steam roads charge, and so in this case also the only way that the electric railway can hope to get a local freight business is to make the same rates as those of the steam roads. Tobacco, corn, wheat and oats can be handled at a profit under many conditions.

We have a chance in this comparatively new field of service to maintain a standard of rates and not repeat our experience in the passenger business and later be obliged to change our rates. I do not believe that an express service on a short line can be maintained as profitably by the railway company itself as it can be by a regular line express company operating over connecting lines; experience of steam roads has been to this effect:

After the division of rates among the various companies the percentage that would revert to the company that originated the business would be so small, that in many cases business would be done at a loss. Delivery and collection by wagons are large items of expense. There are few places on interurban roads where companies can afford to maintain regular delivery wagons. The only way to maintain an express service under conditions that do not warrant the maintenance of wagon service is arrange with local teamsters along the line to handle merchandise from the car to destination. Many roads have tried to conduct an express service but have had to give it up and transfer the business to some electric express company specializing in this class of work.

Already interurban freight is hauled several hundred miles. Realizing that this growth has taken place within a few years, we can see the possibility of the future building of electric lines which will rival steam power systems in hauling long distance freight. And as the industrial and commercial needs press the interurban people to keep pace with the demand for greater freight transportation, this need will be met in the same energetic and progressive manner that has characterized the past development of passenger transportation.

*From a paper read before the 1906 convention of the American Street and Interurban Railway Association, at Columbus, Ohio.

The Northern Railroad of France has asked the Minister of Public Works for authority to introduce a new coal tariff applicable only to shipments in 40-ton (88,000 lbs.) cars, the cars to be furnished by the shippers. By this tariff the shipment of one 40-ton carload would cost 6 per cent. less than if forwarded in the ordinary 10-ton cars; if two 40-ton cars are shipped at once, the reduction will be 7 per cent., and so on, a reduction of 1 per cent. for every additional car up to 16 cars, for which the reduction is to be 21 per cent. The owner of the car will be allowed 5 centimes per kilometer = 1½ cents per mile run loaded. It is contended that if the shippers owned the cars they would ship more evenly throughout the year, instead of sending the chief winter's supply during a few weeks in the fall, when the railroads are most crowded with other traffic.

GENERAL NEWS SECTION

NOTES.

The Texas Railroad Commission has ordered a 20 per cent. reduction of Pullman fares within the state, effective February 1.

A "no seat, no fare" ordinance affecting the local street railways has been promulgated by the Street and Water Board of Jersey City, N. J.

The House Committee on Interstate Commerce reported favorably, January 25, the Sherman bill to prohibit the shipment of explosives in interstate commerce under deceptive markings or invoice.

The New York Central, on its electrified zone in the New York terminal territory, now has a force of "operating inspectors" whose duty it is to supervise the working and care of the electric locomotives and motor cars.

The Seaboard Air Line has notified the North Carolina corporation commission that it will establish the block system on its line between Hamlet and Monroe as recommended by the commission, the distance being 52 miles.

Officials of the Interstate Commerce Commission express the opinion that through effective co-operation by the railroads with the Government, the conditions of distress among the people of that section, arising from a shortage in the supply of railroad cars, have been remedied.

Hours of employment for telegraph operators on the Queen & Crescent have been fixed to extend from 7 o'clock to 7 o'clock, with 25 cents per hour for all overtime. An advance in wages, which it is stated amounted to slightly more than 10 per cent., was also granted. The new rules were made effective January 1.

On January 28 the New York Central began the electric operation of 15 Harlem division trains each way between Grand Central Station and Wakefield. The trains, which are White Plains locals, are made up entirely of motor cars, and are hauled by steam locomotives between Wakefield and White Plains.

Bids were opened in Omaha, January 28, for the transportation of 600 men, 500 horses and a large amount of equipment from Forts Robinson and Russell to San Francisco. Only the Union Pacific and Chicago & North-Western submitted bids, and both bids were for regular and full rates. Railroad officials say the Government will secure no more cheap rates.

It is reported from San Francisco that all lands of the Southern Pacific Company included in the Government grant to the Central Pacific Railroad in California, Nevada and Utah, with the exception of the timber property, will be placed on sale not later than July 1 of this year. The railroad company's holdings in these states amount, approximately, to 6,000,000 acres.

The railroads of Michigan have been assessed at $210,266,000, as against $202,651,000 one year ago. While the total valuation of the railroads is increased by over $7,000,000 the total taxes of the roads are reduced by about $65,000. This is due to the reduction of the rate of taxation, which was this year computed at $16.47 on each $1,000 valuation. One year ago the tax rate was $17.40 on each $1,000.

It is understood that freight handlers and yardmen employed by the New York Central, who, in common with the men employed by all of the lines entering New York and environs have been agitating for an increase in wages, for shorter hours, and for extra pay for Sunday work, will receive 19 cents per hour, an increase of one-half cent, and will have a 10-hour day, with overtime at the rate of time and a half for Sunday work.

According to press despatches from Philadelphia, car builders may lower the prices asked for steel cars since the Pennsylvania has intimated that it will itself build 500 steel coaches for which it is in the market, because the bids it received were so high. It is not known what the bids were, but motive power officials of the railroad say that the price should be between $15,000 and $16,000, or nearly twice that of a wooden car of the same class.

Two locomotives and the cars attached to them were seized in the Santa Fe yards at Lamar, Colo., January 17, by a force of deputy sheriffs, who bound and locked them with heavy steel chains and padlocks. This action was the result of advice from Judge Northcutt to the Prowers County officials to levy on railroad property if $25,000 back taxes, alleged to be due the county from the Santa Fe company, was not paid. Some of the cars tied up by the seizure of two trains contained live stock and others perishable freight. The contested sum was paid under protest.

It is reported that a trackage arrangement has been made between the Gould lines and the St. Louis & San Francisco by which the 'Frisco will run trains over the El Dorado & Bastrop, the New Orleans & Northwestern and the Texas & Pacific, from El Dorado, Ark., just north of the Louisiana line, into New Orleans. Mr. Gould is quoted as saying that the entire low-grade line from East St. Louis to New Orleans will be relaid with heavy rail to provide for greater traffic.

The men employed in all the departments of the Philadelphia & Reading Company's car shops, except passenger car and upholstering, have been put on 13 hours, starting January 18. The order affects 700 men, who have been on 10 hours for some time. The company has a large number of cars needing repairs, and the longer hours were found necessary in order to get them into the service. The order will likewise affect the St. Clair, Palo Alto, Schuylkill Haven and Pottsville shops.

After a conference, January 26, between president of Western lines and the Transportation Committee of the Chicago Commercial Association it was announced that the committe was convinced that a "reciprocal demurrage" law would be impracticable and would not solve the problem of the shortage of freight cars. At the next meeting of its executive committee the association will take action to prevent the passage by Congress and the state legislature of reciprocal demurrage bills which have been introduced.

The special franchise taxes of the Manhattan Railway Company for the years 1900 to 1905, inclusive, have been paid to Comptroller Metz. The Interborough Rapid Transit Company, now the owner of the Manhattan elevated railroad system, forwarded to the Comptroller four checks, amounting to $3,170,141.70. When the United States Supreme Court in May, 1905, finally upheld the franchise tax law as constitutional, the companies brought certiorari proceedings to compel the State Board of Taxes to review the assessments, and referees were appointed to take testimony on the charges of overvaluation. The certiorari proceedings were terminated a short time ago by orders that reduced the assessments to amounts calculated upon the percentages for those years respectively that it was found that the Tax Commissioners of the city of New York had generally accepted as the percentages of assessed valuation to real value for real estate in the boroughs of Manhattan and the Bronx.

Wage increases amounting to $400,000 a year were authorized by the Interborough Rapid Transit Co. January 23. The percentage of the increase varies, the highest being about 16 per cent. The following schedule shows the present and the new rate of wages:

Grade.	Rate per day. Present.	New.	Hours.
Trainmen: First year	$1.70	$1.80	10
" Second year	1.70	1.90	10
" After second year	1.80	2.00	10
" After third year	1.95	2.00	10
Conductors: First year	2.10	2.10	10
" Second year	2.25	2.25	10
" Third year	2.40	2.40	10
" After third year	2.40	2.50	10
Gatemen: First year	1.50	1.70	12
" Second year	1.55	1.80	12
Agents: First year	1.75	1.90	12
" Second year	2.00	2.10	12
" After second year	2.25	2.25*	12
Platformmen: First year	1.75	2.00	12
" Second year	1.75	2.10	12
Hand switchmen: First year	2.25	2.25	10
" Second year	2.40	2.40	10
" After second year	2.40	2.50	10

*A few.

In other departments, such as car equipment, mechanical and maintenance, the wages of the employees will be increased in about the same ratio as given the conductors and trainmen.

Reorganization at Panama.

With the resignation of Theodore P. Shonts as Chairman of the Isthmian Canal Commission it is announced that John F. Stevens, Chief Engineer, will be appointed Chairman of the Commission, thus replacing the work of building the canal directly and entirely under Mr. Stevens' charge and centralizing the administrative forces on the Isthmus. Secretary Taft is to go to Panama after Congress adjourns to supervise the reorganization.

Carnegie Institution Grant to Dean Goss.

The Carnegie Institution of Washington, D. C., has made a grant of $3,000 a year for a period of four years to Dean W. F. M. Goss, of Purdue University, Lafayette, Ind., for the purpose of determining the value of superheated steam in locomotive service; first, in connection with single expansion engines; and second, in connection with compound engines. This is the second grant which the institution has made to Dean Goss. While given to him person-

ally, its effect will be to stimulate and to make more effective the work of the Purdue locomotive laboratory. Funds thus received will be employed in supplementing the resources of the laboratory as derived from all other sources. The results of Dr. Goss's previous research under the auspices of the Carnegie Institution, which was for the purpose of determining the value of different steam pressures in locomotive service is now in press.

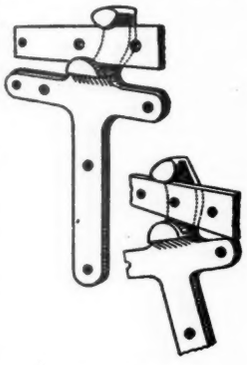
What Is a Box Car?

A box car belongs to the fowl family. During the spring and summer months it can be found in nearly every part of the country, its favorite haunts being railroad tracks, and it is easy to capture. In the autumn, however, like certain other fowls it goes into hibernation or flies to other climes. Scattered instances are known where specimens are captured during the autumn months. A lasso or a well-greased switch crew is sometimes used in snaring the box car, but main strength is the best weapon. In any case the hunter must be very wary, as any noise like the fluttering of a waybill will make the quarry disappear. Some railroads own large flocks of domesticated box cars, but they are carefully guarded during the close season. The wild box car when caught and fairly well loaded becomes perfectly stationary.—*Exchange.*

A New Car Door Hanger.

A new design of car door hanger is illustrated herewith. It is called an oblique hanger because of the form of the upper part. When this part is held in a vertical position, as one view shows, the flanges clear the rail, but when the hanger is dropped to normal position, with the lower part vertical, the flanges engage the rail, retaining the hanger in place. The upper and lower contact surfaces are rounded to minimize the bearing friction. The hanger may be applied to either flush or projecting doors. When applied to flush doors, the hanger nearest the advancing edge of the door when it is opened is given a pivot hinge to permit inward and outward movement of the door.

The full flush-door equipment includes a vertical crank-rod on the same side as the hinged hanger. This rod has the usual hand lever revolving through a semi-circle for releasing and fastening the door. At its upper end is a crank and pin, and as the door is closed the pin enters a slot in a horizontal flat plate fastened rigidly to the body of the car. A similar crank and pin at the bottom engages a slot in a shoe grooved to engage the lower rail. The rails are bent inward at the proper point to carry the hanger and shoe of the opposite edge of the door to the closed position. It is claimed that this equipment makes a flush door spark-proof as well as burglar-proof.



The Baker-Stewart Oblique Car Door Hanger.

For the projecting door the two bottom fixtures contain each a vertically-moving bolt which has an inwardly-extending offset portion near its lower end, notched for engaging the rail. When the door is closed the lower end of the bolt may be pushed down behind the rail. To open the door, the bolts are raised, the door pulled outward and the bolts lowered until the slots engage the rail. When opened to the desired point the bolts are disengaged from the rail, the door pushed inward and the bolts again dropped, holding the door against motion in any direction.

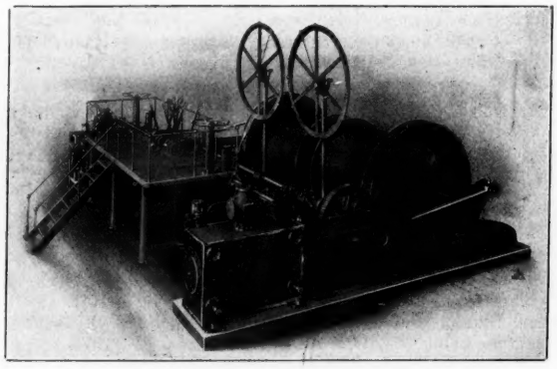
The hanger may be used not only with the equipment described, but with any other type of shoe commonly used on car doors, or with doors having no lower track and which close in a recessed bracket. The hanger is also made in small sizes for small ventilating car doors and also for barn doors. The Baker-Stewart Door Equipment Co., Indianapolis, Ind., is the maker.

Railroad Department Established by Hapgoods.

Hapgoods, the firm of employment experts, 305 Broadway, New York, has added to its organization a department devoted entirely to transportation, in charge of practical expert railroad men. This department is placing men experienced in railroad work in better positions in that line or finding them openings with mercantile houses, where their abilities are brought into play. This should be especially appreciated by firms doing a great deal of shipping, as the day of the rebate securing traffic manager is over and these high-salaried lobbyists are being replaced by thoroughly experienced railroad traffic men. Practically any kind of transportation man can be handled by this department, from the young clerk to the auditor or chief engineer. There are many instances where a man gets into a rut, and, do what he will, seems anchored to his present condition. Although he has abilities for a far better thing, he lacks opportunity. It is believed that this department will afford needed relief, and it is hoped that railroad men will avail themselves of its service.

A Large Mine Hoisting Engine.

The Hancock Consolidated Copper Co., John L. Harris, Superintendent, whose mines are located at Hancock, Mich., has ordered from the Sullivan Machinery Co., Chicago, a hoisting engine to be used for sinking the principal shaft, and for permanent service after the shaft is completed to its final depth of 4,000 ft. This hoist will be of the first motion, heavy duty, Corliss type, with engine cylinders 24 in. in diameter by 48-in. stroke, and two loose drums,



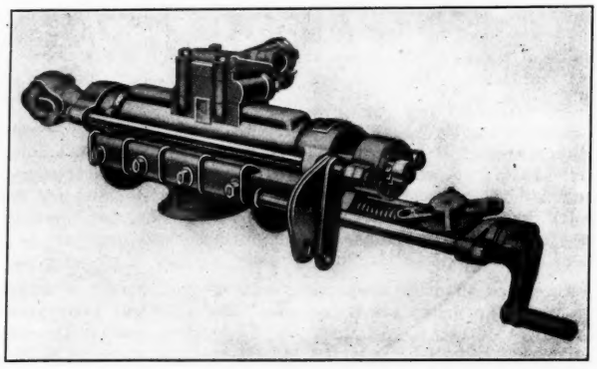
Sullivan Mine Hoist.

8 ft. in diameter by 9 ft. long, driven by hand friction clutches, and designed for hoisting in balance. The drums will be grooved for 1¼ in. steel rope, and the maximum hoisting speed under full load will be 3,500 f.p.m. The clutches and band brakes will be steam operated, with automatic compressed air substitution in case the steam pressure falls below a given point, due to accident or other reasons.

The hoist will be equipped with the Sullivan patent automatic throttle-closing device and interlocking automatic stop. By these contrivances the steam is automatically shut off at a fixed distance from the top of the shaft, allowing the engineer to bring the cage to a stop at the desired point by use of the brake. In case the engineer, for any reason, fails to set the brakes, they will be set automatically at the proper point to prevent an overwind. Hoists of this same design have recently been furnished to the Republic Iron & Steel Co., Republic, Mich., the Ironton and Colby Mines, Bessemer and the Dunn Mine, Crystal Falls, Mich. The accompanying illustration is of the Ironton mine hoist.

The "Chicago Giant" Rock Drill.

The latest improved design of the "Chicago Giant" machine rock drill is shown in the accompanying illustration. It has a number of new features. The shell, of which is of the adjustable type, provides for a double side bearing for the cylinder. The shell caps will take up wear in two directions, horizontal and vertical, with one adjustment. A removable cylinder stop is also provided in the lower end of the shell, its function being to prevent the cylinder from slipping out of the shell in case the feed screw should be run out of the feed nut. To remove the cylinder from the shell the stop is removed first; then by turning the feed screw the cylinder is run down in the shell until the feed screw is out of the feed nut, allowing the cylinder to be slipped out of the shell without dismantling the machine.



"Chicago Giant" Rock Drill.

The cylinder is cast from a special mixture, having a tensile strength of 35,000 to 38,000 lbs. and presenting a fine polished surface when finished. The upper end of the cylinder is extended to form a chamber for the rotating mechanism, which is of the releas-

ing type. Three parts are used, equally distributing the rotating effort, and the pawls are made reversible; that is, should one of the engaging edges wear out, the pawl can be reversed so as to present the other unworn edge to engage with the ratchet. This doubles the life of each pawl. The ratchet is one piece with the rotating or rifle bar, which is extended on its upper end to fit into a chamber or recess in the upper head. This holds the rotating bar in a central position and relieves the rotating mechanism of side stresses.

The valve motion is positive and is of the tappet or rocker type, modified to give a short stroke feature, the length of the stroke being at all times completely under the control of the operator. The supporting pin of the rocker works in renewable steel bushings, is completely enclosed, and is kept in place by removable caps, locked in place by the valve seat when the machine is assembled.

An important feature is automatic lubrication. An oil chamber is provided in the valve seat communicating with the interior of the valve chest. Here the oil mixes with the operating fluid and is carried by it into the interior of the machine. One filling of the oil reservoir will last half a "shift." In case the rotating mechanism should not receive sufficient lubrication from the interior it may be oiled through the upper head when necessary.

High-grade materials, carefully fitted, are used, and parts are interchangeable. The drill works best and most economically with compressed air, but may be operated by steam, its positive valve motion and liberal port areas enabling it to work with steam that would be too wet for many rock drills. The Chicago Pneumatic Tool Co., Chicago, is the maker.

Railroads in Chile.

The government of Chile has arranged with a Belgian syndicate to build part of what is known as the "Longitudinal" railroad from Valparaiso north along the coast to Copiapo, 435 miles.

At the present time, with the exception of a few small lines, all the railroads in Chile are owned and operated by the government, but these are not self-supporting; on the contrary, they are an immense expense every year, the annual deficit amounting to several millions of dollars. This new line is to be a departure from this system.

The Belgian syndicate has had engineers examining the route, making plans and specifications, and preparing bids. The proposition of the syndicate has been accepted by the government and is now before Congress for its approval. For 50 years from the time work is started, the syndicate will own and operate the road, and at the end of that time the government shall have the right to buy it at an appraised valuation. The syndicate must pay to build and operate the line, but the Chilean government will guarantee an annual interest of 5 per cent. on the investment. Should the net earnings exceed 5 per cent. the excess up to 7 per cent. is to be equally divided between the syndicate and the government.

It is understood that work is to be commenced as soon as the project receives the approval of the Congress.—*Consular Report.*

Interborough Relief Fund.

The following relief fund plan has been announced by the Interborough Rapid Transit Co.:

Employees who join the fund will be divided into three classes —those who receive a monthly pay of less than $35, those who receive more than $35 and less than $75, and those receiving more than $75. Monthly payments will be at the rate of 75 cents for the first class, $1.50 for the second class and $3 for the third class.

If a motorman or conductor is disabled he will receive $2 per day for the first fifty-two weeks and $1 per day after that. In case of sickness, after the first six days and not longer than fifty-two weeks, those in the first class will receive 50 cents per day, the second class $1, and the third class $2.

By the death benefit plan, on the payment of a small amount the employees are insured for the benefit of relatives and other beneficiaries at the rate of $250 in case of death to those in the first class, $500 in the second class and $1,000 in the third class.

Persons in the service of the Interborough Company at the time of the inauguration of the relief department, January 15, will, until July 1, be afforded the privilege of becoming members of the fund without regard to age and without physical examination.

Projected Railroads in Texas.

The projected lines and those now under construction in Texas, according to the State Railway Commission, are as follows: Weatherford, Mineral Wells & Northwestern, from Mineral Wells to Texas-New Mexico state line, 275 miles; Kansas City, Mexico & Orient, from Sweetwater to San Angelo, and from San Angelo to Spofford or Del Rio, and from Knox City to the Red river, 150 miles graded, total projected 600 miles; Beaumont, Sour Lake & Western, from Trinity river to Houston, 45 miles; Beaumont & Great Northern, from Onalaska to Livingston, 15 miles; Brownwood & Cisco, from Brownwood to Cisco, 55 miles; Chicago, Rock Island & Gulf, from Carrollton to Irving, 12 miles; Gulf, Colorado & Santa Fe, from Brownwood to Texico, 350 miles; St. Louis, San Francisco & Texas, from Brady to San Antonio, 150 miles; Port O'Connor, Rio Grande & Northern, from Port O'Connor to San Antonio, with several branch lines, partly graded, 350 miles; Trinity & Brazos Valley, from Corsicana to Waxahachie, graded, 30 miles; Trinity Valley Northern, from Dayton to Cleveland, 30 miles; Wichita Falls & Northern, from Wichita Falls to the Red river, 20 miles.

Settlement of Firemen's Strike in Texas.

The general committee of adjustment of the Brotherhood of Locomotive Engineers (Atlantic system, Southern Pacific) has requested Vice-President and General Manager T. Fay to reinstate all engineers who left the services of the company on December 23 in their places on the seniority list, so far as the company desires to re-employ them, and the request has been readily granted. It is thought that this action forever settles the question of the right of the Brotherhood of Locomotive Engineers to adjust all differences between the railroad and all engineers, both road and yard, and that it forever settles the question upon which the strike of December 23 was ordered, the principal contention being that the Brotherhood of Locomotive Firemen should have control over yard engineers.

Clothing the Prairie With Silk.

Ten express cars loaded with Oriental silks on a special train on the Great Northern were derailed at Clontarf, Minn., January 19, during a blizzard. The cars were badly wrecked, and trainmen and citizens hunted silk all night.

To Reduce Freight Claims.

Freight and passenger agents on a division of the Chicago & North-Western have organized under the local name of the North-Western Agents' Association. The plan will be tried later on other divisions. Assistant inspectors will be appointed, to travel on freight trains wherever advisable, making suggestions to conductors and brakemen in relation to the handling of freight, thus reducing the claims against the railroads on account of damages.

Freight on Empty Coal Cars.

The management of the Harriman lines is reported to be paying $32,500 freight on cars in order to get them from the East into the coal fields of Illinois, where they can be loaded with coal for the West. The question arose of how to get the cars to the mines without having some road steal them for temporary use en route. The management finally decided to ship them as freight, and is paying $25 for the delivery of each car.

Boycott Against Trolley Roads Raised.

It is reported that as a result of a conference with D. G. Edwards, vice-president of the Consolidated Electric Railways of Indiana and Ohio, having about 1,200 miles of track, the passenger officials of the steam roads in that territory have decided to abrogate their agreement not to interchange traffic with electric lines. The electric lines had agreed to notify the Interstate Commerce Commission of the boycott declared against them by the steam roads and ask that body to enforce the section of the act to regulate commerce which requires all carriers to interchange traffic.

Projected Railroad in Peru.

A law has been passed for building a railroad from Lima, Peru, northwest to Huacho, about 80 miles, with branches to the ports of Chancay and Supe. The contractors are guaranteed 6 per cent. a year on the cost of construction and control of the road for 30 years.

Railroad Building in Manchuria.

It is reported from Japan that the Southern Manchuria Railway Company is to build an extensive system of railroads in southern Manchuria, with principal seaboard terminus at Dalny. These lines will cost about $10,000,000, half of which the Japanese Government has subscribed, the other half to be furnished by Japanese and Chinese bankers. Narrow gage lines are to be made standard gage, and coal mines developed.

Opening of Tehuantepec National Railway for Through Freight.

The Tehuantepec National Railway, as part of a through freight route between Atlantic and Pacific ports, was formally opened by President Porfirio Diaz, of Mexico, January 23, at Salina Cruz, the Pacific terminus of the road, by pressing a button which set in motion a crane that raised a shipment from the hold of the steamship "Arizona" of the American-Hawaiian Steamship Company and put it on board a freight car billed to Coatzacoalcos, the Atlantic terminus. The three doors of the railroad station at Salina Cruz were opened by President Diaz, Minister of Finance Limantour and Minister of Public Works Fernandez with golden keys. Sir Weetman Pearson, resident partner of S. Pearson & Son, Ltd., reviewed the work of construction and its two terminal harbors, and predicted that although the road is now capable of handling 1,000,000 tons of freight a year, its success as a traffic carrier would be so great that within seven years or less double-tracking would be neces-

sary. After the ceremonies a trip across the Isthmus was made in a special train to Coatzacoalcos, now renamed Puerto Mexico, where President Diaz unlocked a car containing the first shipment which he locked at Salina Cruz. Descriptions of the improvements made on the Isthmus of Tehuantepec were described in the *Railroad Gazette* of July 15, 1904, and November 9, 1906.

Railroad Extension in Hayti.

A concession has been granted by the Haytian Government to the United Hayti Corporation, with a capital of $15,000,000, to take over the National Railroad of Hayti, to operate a number of mining concessions and a direct steamship service to the United States and to Europe. The National Railroad of Hayti is the only railroad on the island and at present is only 30 miles long. It is planned to extend it from the present terminus south of the seaport of Gonaives to Hinche, a distance of 80 miles. This extension is expected to be finished by July next. A new road is also planned from Cape Haytien on the northern coast across the island through Hinche and Port au Prince. The extension of the National Railroad and the new line will traverse a rich copper, iron and coal district in the interior. Contracts have already been let for building piers and docks at Cape Haytien, Gonaives and Port au Prince. The Haytian Government guarantees six per cent. interest on an expenditure of $24,000 per mile for the railroads for a period of 50 years. All the rails, locomotives, cars and other equipment will be purchased in the United States. Among the promoters of the project are: William G. Price and John B. Mayer, of Philadelphia; O. B. Bechel, of Pottsville, Pa., and F. L. Price, of Tamaqua, Pa.

Compliance with the Rate Law.

The operating and passenger departments of the Baltimore & Ohio have sent out a circular letter to all ticket agents and passenger conductors, impressing upon them the importance of strictly complying with the Rate Law and forbidding any deviation from the passenger rates fixed by the tariff. They are told that there must not be a single exception to the prescribed rates, and that the railroad company, its officers, agents or other employees wilfully violating the law or wilfully permitting the same to be done, are subject to a fine of from $1,000 to $20,000 for each offence and are liable to imprisonment for two years. The letter explains that the same penalties are levied against passengers for any wilful act whereby they secure transportation at less than tariff rates.

Subway Connection between Brooklyn Bridges.

The Board of Estimate and Apportionment of New York City on January 25 voted in favor of a four-track subway loop to connect the Manhattan terminals of the Brooklyn and Williamsburgh bridges to be built by the city at an estimated cost of $5,245,000, which includes $500,000 for four stations. It will take about three years to build this connection. This ends the long controversy as to whether the two bridges should be connected at all, and, if so, whether by a subway or an elevated structure.

Profits of Japanese Steamships.

A consular report says that the net profits of the Nippon Yusen Kaisha (Japanese Steamship Co.) for the six months ended Sept. 1, 1906, were $622,000, to which was added a surplus of $491,700 from the preceding period. Of this sum $31,000 was placed to the reserve, $35,600 paid in bonuses to officials, $550,000 used for a 10 per cent. per annum dividend and $110,000 for a special 2 per cent. dividend (thus maintaining the usual 12 per cent. dividend), leaving a surplus of $387,100.

The company has placed orders with Japanese shipbuilding yards for the construction of six steamers, each of 8,600 tons, and they are expected to be completed in the course of 1908. For the payment of the cost of these steamers no loan will be raised, but the cost is to be drawn on a surplus so far accumulated and also on the reserve to be set aside for the depreciation of the value of steamers.

Panama Canal Contract.

The lowest bid submitted for building the Panama Canal was that of Oliver & Bangs, who agreed to do the work for 6.75 per cent. of the cost of construction. As satisfactory assurances of the financial standing of Mr. Bangs were not obtained, it was ruled that he could have no share in the contract. William J. Oliver, of Knoxville, Tenn., the other member of the firm, may, however, receive the contract, if by February 6 he can secure at least two independent contractors whose skill and experience combined with his own shall cover the whole field of work to be performed under the contract, and organize a corporation for the express purpose of carrying out the contract, this corporation to have a capital of $5,000,000, of which not less than $1,000,000 paid in cash and $1,500,000 in solvent subscriptions shall be available for carrying out the contract, and of which another $2,000,000 may be devoted to the purpose of procuring a bond as required by the contract, or as substituting instead, subject to the conditions of the bond, satisfactory cash or current securities. The next lower bidders were the MacArthur-Gillespie Company, who have been given the privilege of either withdrawing their bid or of allowing it to remain awaiting the result of Mr. Oliver's efforts to make good his bid. The other petitions have been rejected because informal and, in the case of the highest bid, excessive as well. It was announced on January 30 that Frederick C. Stevens, Superintendent of Public Works of New York State, is associated with Mr. Oliver in this contract.

Rail Production in the United States.

The *Wall Street Journal* reports that the rail mills of the United States have orders for a larger tonnage than ever before. Including business carried over from last year, the contracts aggregate nearly 3,000,000 tons, which is almost the total production of 1905.

The following table gives the production of all classes of steel rails from 1900 to 1906 inclusive, with 1907 estimated:

	Tons rails.	Price.	Gross sales.
1907	*4,000,000	$28.00	*$112,000,000
1906	3,650,000	28.00	102,200,000
1905	3,372,257	28.00	94,423,200
1904	2,284,711	28.00	63,971,900
1903	2,992,477	28.00	83,789,300
1902	2,947,933	27.33	82,542,100
1901	2,874,639	27.33	78,463,800
1900	2,385,682	22.29	76,933,700
Total	24,507,699		$694,324,000

*Estimated.

A Modest Railroad Project.

There is being offered for sale a $50,000,000 stock issue of the Transcontinental Electric Railroad Company, a corporation which proposes to build a number of railroad lines. The principal main line is to run from some point in the vicinity of New York City to a point in Illinois on the Mississippi river, with a branch parallel to the Mississippi from the Gulf of Mexico to Lake Michigan. The $50,000,000 stock issue is one of a series of similar issues to be issued as required. The road will no doubt soon be in successful operation.

Asbestos Building Lumber.

A fireproof building material, composed entirely of asbestos fiber and hydraulic cement, is now commercially available, and can fairly be classed as one of the new and valuable materials of construction. This much can be said of it without testing: Because of its constituents it is fireproof, not affected by moisture or frost,

tough, hard, has only slight expansion and contraction due to heat or cold, does not crack or exfoliate when exposed to fire, needs no painting, has high insulating qualities for electric resistance, and, so far as observed during the past four years, its valuable peculiarities seem to increase with age. Its value for roofing shingles, sheathing on buildings liable to be set on fire by electric short circuiting, and for electric car construction, is quite obvious. It is made for and sold by the Franklin Mfg. Co., Franklin, Pa.

Transportation of Newspaper Employees on Special Trains.

The Interstate Commerce Commission, through Commissioner Harlan, has given an opinion in the matter of free transportation of newspaper employees on special newspaper trains. The opinion was given in answer to a petition of certain newspapers in New York City. It appears that the New York, New Haven & Hartford runs two special Sunday morning newspaper trains from New York, one to Springfield, the other to Boston. In compensation for this special service the railroad company receives 50 cents for each 100 lbs of newspapers carried; the total weight has usually been from 70 to 80 tons. It has been the custom to include in the service given by the railroad free transportation for certain newspaper employees, whose duty it was to assort the papers and make them up into packages for delivery as the train arrived at the various stations along the road, and free transportation of such employees from Springfield and Boston back to New York on any regular passenger train. The Commission holds that these so-called caretakers of newspaper companies may not lawfully be granted the free transportation that is permissible under the rate law to caretakers of certain other kinds of traffic specifically enumerated, and also that a commodity rate cannot be applied to the transportation of passengers or a passenger rate to the transportation of commodities; this latter point covering the question as to whether under a rate for carrying newspapers, transportation of employees of newspaper companies can be directly included. The Commission rules, therefore, that newspaper employees cannot lawfully be carried on special newspaper trains at any other than the regular passenger rates.

Damages for Revoke of Pass.

A damage suit attacking the validity of the Interstate Commerce law was filed in the United States Court at Louisville, January 24, by Erasmus L. Mottley and Annie E. Mottley, his wife. The defendant is the Louisville & Nashville Railroad. Plaintiffs allege that while passengers on a Louisville & Nashville train on September 7, 1871, they were seriously injured in an accident at Randolph, Ky.,

and that as a compromise of a threatened damage suit they were to receive annual passes for the rest of their lives. They allege that a written contract exists to that effect. They now ask $10,000 damages if the rescinding of their passes is upheld.

High Record Steel Business.

A statement was given out after the quarterly meeting of the directors of the United States Steel Corporation, this week, showing $41,744,964 net earnings for the December quarter, $151,619,111 net earnings for the year, and 8,489,718 tons of unfilled orders on hand. The surplus after charges and preferred and common stock dividends for the quarter ended Dec. 31, 1906, is $18,824,545, as compared with $14,697,318 in the previous quarter, and a surplus after charges and preferred stock dividend, only, in the corresponding quarter of 1905, of $16,416,563. From the surplus for the quarter there was appropriated $15,500,000 on account of expenditures made and to be made on authorized appropriations for additional property, construction and discharge of capital obligations. This leaves a balance of surplus for the quarter of $3,324,545.

The net earnings of the United States Steel Corporation for the last three years compare monthly and quarterly as follows:

	1906.	1905.	1904.
January	$11,856,375	$6,810,847	$2,868,213
February	10,958,275	6,629,463	4,540,673
March	13,819,840	9,585,586	6,036,346
First quarter	$36,634,490	$23,025,896	$13,445,232
April	$12,581,902	$9,037,925	$6,863,833
May	14,041,601	10,602,187	6,256,518
June	13,501,530	10,665,004	6,370,374
Second quarter	$40,125,033	$30,305,116	$19,490,725
July	$12,242,098	$9,035,168	$6,344,771
August	13,158,860	10,986,901	6,202,957
September	12,713,666	11,218,513	6,226,204
Third quarter	$38,114,624	$31,240,582	$18,773,932
October	$14,984,926	$12,400,306	$7,250,204
November	13,482,464	11,827,215	7,117,418
December	13,277,574	11,051,167	7,099,011
Fourth quarter	$41,744,964	$35,278,688	$21,466,633
For year	$156,619,111	$119,850,282	$73,176,522

The unfilled orders on the books of the company have been as follows on the dates mentioned, the figures being given in tons:

	Tons.		Tons.
December, 1906	8,489,718	June, 1904	3,192,277
September, 1906	7,936,884	March, 1904	4,136,961
June, 1906	6,809,589	December, 1903	3,215,123
March, 1906	7,018,712	September, 1903	3,278,742
December, 1905	7,605,086	June, 1903	4,666,578
September, 1905	3,865,377	March, 1903	5,410,719
June, 1905	4,829,655	December, 1902	5,347,523
March, 1905	5,597,560	September, 1902	4,843,007
December, 1904	4,696,203	June, 1902	4,791,993
September, 1904	3,027,436		

Senate Resolution on Block Signals.

The following resolution passed the United States Senate on January 29:

Whereas, On June 30, 1906, Congress passed a joint resolution directing the Interstate Commerce Commission to investigate and report on block signal systems and appliances for the automatic control of railroad trains, directing an investigation and report on the use of and necessity for block signal systems and appliances for the automatic control of railroad trains in the United States, and whereas such investigation and report was directed in the interest of protecting human life and preventing accidents on railroad trains;

Therefore Be It Resolved, That the Interstate Commerce Commission be and it is hereby directed,

First—To inform the Senate to what extent said investigation has been made;

Second—To transmit to the Senate such information as the Commission may have acquired on this subject;

Third—To inform the Senate whether or not it is wise to require railroad companies to equip their lines with the automatic block signal system;

Fourth—What length of time would be required to put in operation such system and its probable cost.

Fifth—The number of deaths caused by accidents on railroads during the years 1900, 1901, 1902, 1903, 1904, 1905 and 1906, and to what extent, if any, the death rate can be diminished by the adoption of the automatic block signal system.

Progress of Invention in Mississippi.

Two prolific inventors in a small town in Mississippi (we hesitate to mention names, but one is a clergyman) have obtained a patent on a means for preventing collisions when enginemen run by stop signals. They have, to quote the patent specification, "invented certain new and useful improvements in means for oiling tracks and applying the air-brakes for stopping railroad trains, and we do hereby declare the following to be a full, clear and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same. For neutralizing the traction power of the locomotive engine of a railroad train and for stopping the train we provide means operated by a track device which is operated by the movement of the train for effecting a flow of oil upon the top of the rails in front of the drivers and by the same means which effects the oil flow to cause the brakes to be partially applied to destroy the momentum of the train, and while the slipping of the drivers will be effective to stop the train the conjoint effect of the oil flow and applying the air-brakes will conduce to greater effectiveness and safety without the intervention of the engineer who from any cause may be incapacitated to act on the showing of the danger-signal. The design of our invention is to make the engineer more careful, and in the event of his failure to note the signal then the movement of the train will bring into action means for causing the oiling of the rails in advance of the drivers in conjoint co-operation with means for automatically operating the air-brake lever to apply the brakes."

Shipbuilding in 1906.

In 1906 there were 207 vessels launched at American shipyards against 361 in Germany, 511 in Scotland and 882 in England. The tonnage built in American yards, however, is greater than that in German yards. The yards on the Great Lakes, many of which are controlled by the American Ship Building Company, were specially busy. A detailed account of the new construction on the Great Lakes appeared in the *Railroad Gazette* of October 26, 1906.

The following table shows the tonnage built at the principal yards and the total production of the United States during the last two years:

	1906		1905.
	Vessels.	Tons.	Tons.
American Shipbuilding Co. (6 yards)	34	198,535	136,795
Great Lakes Works	9	48,671	43,470
W. Cramp & Sons	7	37,119	31,942
Newport News Co.	5	36,700	19,006
New York Shipbuilding Co.	12	35,500	34,300
Fore River Shipbuilding Co.	7	15,075	16,220
Toledo Shipbuilding Co.	4	12,808	5,360
Harlan & Hollingsworth	15	10,859	11,548
Delaware River Works	4	10,124	129
Maryland Steel Co.	10	8,857	22,928
United Engineering Works	12	7,744	1,910
T. S. Marvel	3	7,647	662
Cobb, Butler & Co.	3	3,709	620
Burlee Dry Dock Co.	4	1,472	2,006
J. H. Dialogue & Son	9	1,418	.....
Merrill-Stevens Co.	4	1,076	.....
Neafie & Levy Co.	5	699	352
Gas Engine & Power Co.	11	365	392
Skinner Shipbuilding Co.	2	331	600
Other firms	47	25,962	40,051
Total	207	464,671	368,491

TRADE CATALOGUES.

Concrete Piling.—The Raymond Concrete Pile Co., Chicago, has prepared a new edition of its catalogue concerning its system of concrete pile construction and foundations. This system, as our readers are aware, involves the use of a sheet steel form or shell driven into the ground by means of a collapsible steel cone, which is then withdrawn and the shell filled with concrete. The method is fully described and illustrated in the catalogue and the economy and advantages of the system set forth. A list of well-known architects and engineers who have used the piling is given, and a large number of views of buildings and other structures resting on this piling, or of the piling driven ready to receive the superstructure. There are also fac-simile testimonial letters from architects and engineers, and at the back is a reprint of an article by W. R. Harper, inspector in charge of the Academic group of buildings at the United States Naval Academy, concerning the use of Raymond concrete piling for the foundations for those buildings.

High Duty Metal Saws.—A recent catalogue of the High Duty Saw & Tool Co., Eddystone, Pa., illustrates and describes various types of cold sawing, cutting off and rotary slotting machines employing the "Tindel" high duty saw blades with inserted high-speed steel cutting teeth. The distinguishing feature of these machines is the "Paragon" driving mechanism, which employs only straight and bevel gears without worm gearing of any kind. This form of drive applies the power direct to the saw blade without the use of an arbor, and the point of application is below the cutting plane, so that the saw is pulled and not pushed through the work.

Diamond Core Drills.—Catalogue No. 55 of the Sullivan Machinery Co., Chicago, is on the subject of diamond core drills. The "foreword" explains the two principal objects of the book, which are: To give a proper idea of the theoretical and practical advantages of prospecting mineral lands with the diamond core drill; and to gather under one cover all the information necessary to the selection of a suitable drilling outfit, its purchase, use and maintenance. The book is standard size (6 x 9) and contains 157 pages. It covers quite completely the points mentioned and is well and fully illustrated.

Manufacturing and Business.

The Lidgerwood Manufacturing Co., New York, has removed its Chicago office, W. H. Baldwin, Sales Manager, from the Old Colony Building to 1917 Fisher Building.

Edmund H. Walker, who has for the past two years been Assistant to the President of the Standard Coupler Company, 160 Broadway, New York, has been appointed General Sales Manager.

The Colorado Gray Iron Foundry Co., 418 Majestic Building, Denver, Colo., has moved its offices to 1736 Broadway. The Estell Car Seal & Equipment Co. will also have its offices at the same place.

Crane Co., Chicago, now have their new steel foundry in full running order. In this department steel valves and fittings will be a specialty, and the facilities are such that prompt filling of orders is assured.

The Lock Joint Pipe Co., 346 Broadway, New York, has received an order from the Louisville & Nashville to protect with its sectional concrete pipe the piling in a portion of the Commendencia street wharf at Pensacola, Fla. The piles are all creosoted, and have been standing for eight years.

The Link-Belt Company, Philadelphia, Chicago and Indianapolis, has opened a branch office at 321 Ellicott Square Building, Buffalo, N. Y., in charge of H. C. Minier, to handle sales of its drive chains in Buffalo and neighboring territory in New York, Pennsylvania and Ohio. The company has also opened an office at 440 New York Block, Seattle, Wash., in charge of E. G. Brabrook, to handle conveying machinery in that territory.

Iron and Steel.

The Harriman lines are in the market for an additional 8,000 tons of rails.

The Long Island has ordered 2,000 tons of structural material to the Pennsylvania Bridge Company of Pittsburg; the Chicago & North-Western has ordered 1,100 tons of bridge material.

A number of railroads are in the market for small tonnages of bridge material amounting to about 8,000 tons, including the Erie, the New York, New Haven & Hartford and the New York Central & Hudson River. The St. Paul recently let contracts for over 8,000 tons, divided among four different shops, and is still negotiating for more.

OBITUARY NOTICES.

Hon. Andrew G. Blair, formerly Minister of Railways and Canals of Canada, died suddenly at Fredericton, N. B., from heart failure on January 25. He was born in Fredericton in 1844. He became a lawyer and later went into politics, soon becoming leader of the Liberal party in New Brunswick. In 1896, when the Liberals attained power in the Dominion, he was made Minister of Railways and Canals in the administration of Sir Wilfrid Laurier. This position he held for seven years, which were characterized by great activity in railroad building. He resigned in 1903 owing to a difference with his colleagues as to the policy to be pursued in regard to the construction of the Grand Trunk Pacific. Shortly afterwards he was appointed Chairman of the newly-constituted Board of Railway Commissioners, from which post he resigned in the fall of 1904.

Jonah H. White, Eastern Passenger Agent of the Atlantic Coast Line, died at his home, 120 East Eighty-fifth street, New York, on December 30, in his 76th year of life and his 36th year in the company's service. He was a fine type of the southern gentleman, with a memory for faces and names and an attentive courtesy which exalted and dignified his minor official position, with a result that few men had more personal friends and acquaintances than "Jonah." He liked to see his passengers safely aboard their trains, and they liked to see him. He was a great business getter; done by attention and courtesy. Mr. Craig, Passenger Traffic Manager, has issued a special circular, with Jonah's portrait and with this summary: "His work was characterized by the highest standard of loyalty, faithfulness and courtesy, such that commanded the respect and esteem alike of the officials of this company and of the traveling public."

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

The Engineers' Club of Philadelphia.

At a business meeting of this club to be held February 2 there will be a paper on "Single-Phase Railways," illustrated by lantern slides, presented by F. E. Wynne. At the twenty-eighth annual meeting of the club January 19, 88 members and visitors were present. The election of officers resulted as follows: President, Henry H. Quimby; Vice-President (for two years), W. P. Dallett; Secretary, Walter Loring Webb; Treasurer, George T. Gwilliam; Directors, J. W. Ledoux, John T. Loomis and Emile G. Perrot.

Iron and Steel Institute.

The annual general meeting will be held at the Institution of Civil Engineers, Great George street, London, S. W., on May 9 and 10, 1907, and the annual dinner will take place—under the presidency of Sir Hugh Bell, Bart.—in the grand hall of the Hotel Cecil, on Friday, May 10. The council will shortly award Carnegie Research Scholarships. Candidates must apply before February 28. The awards will be announced at the general meeting. Bennett H. Brough, Secretary, 28 Victoria street, London, S. W.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Little Rock & Hot Springs Western.—C. A. Pratt has been elected Vice-President.

Pennsylvania Company.—See Pittsburg, Cincinnati, Chicago & St. Louis.

Pennsylvania Lines West.—See Pittsburg, Cincinnati, Chicago & St. Louis.

Pittsburg, Cincinnati, Chicago & St. Louis.—J. L. Mason has been appointed Assistant Secretary of this road and of the Vandalia and of the Pennsylvania Company, which operates the northwest system of the Pennsylvania Lines West.

Temiskaming & Northern Ontario.—A. J. McGee, General Accountant, has been appointed Secretary, succeeding H. W. Pearson, resigned.

Vandalia.—See Pittsburg, Cincinnati, Chicago & St. Louis.

Operating Officers.

Atchison, Topeka & Santa Fe Coast Lines.—J. A. Christie, Trainmaster at Barstow, Cal., has been appointed Acting Superintendent of the Valley division, with office at Fresno, Cal., J. W. Walker having been granted leave of absence.

Canadian Pacific.—G. P. Bury, General Superintendent at Winnipeg, has been appointed to the new office of Assistant General Manager of western lines. A. Price, Superintendent of Transportation of western lines, succeeds Mr. Bury, and the office of Superintendent of Transportation has been abolished.

Grand Trunk.—J. J. Connelly, Trainmaster of the Fourth and Fifth districts, with office at Montreal, has been appointed Trainmaster of the Second and Third districts, with office at Richmond, Que., and the office of Trainmaster of the Fourth and Fifth districts has been abolished. C. L. Mayne, Assistant Superintendent of the First, Second and Third districts, has been appointed Superintendent of Montreal terminals, including the lines to St. Lambert and Lachine, and the Jacques Cartier branch, succeeding J. L. Gogerty, resigned, and will also be in charge of the Fourth district, succeeding Mr. Connelly. Mr. Mayne's office will be at Montreal. H. F. Coyle, Trainmaster at Belleville, Ont., succeeds Mr. Mayne, with office at Island Pond, Vt. L. G. Coleman, Assistant Superintendent at Ottawa, Ont., has been appointed Assistant Superintendent of the Fifth, Sixth and Seventh districts, with office at Belleville, Ont. Stanton Ennes, Master of Transportation at London, Ont., succeeds Mr. Coleman.

Illinois Central.—A. E. Clift, Superintendent at Freeport, Ill., has been appointed Superintendent at Carbondale, Ill., succeeding C. L. Ewing, promoted. E. Dailey, Trainmaster of the Amboy division, succeeds Mr. Clift. G. E. Patterson, Trainmaster at Freeport, succeeds Mr. Dailey, with office at Freeport. S. H. Duckworth, chief despatcher at Kankakee, Ill., succeeds Mr. Patterson.

Lehigh Valley.—John F. Maguire, Superintendent at Wilkesbarre, Pa., has been appointed Assistant Superintendent of Transportation, with office at South Bethlehem, Pennsylvania.

Traffic Officers.

Baltimore & Ohio.—L. R. Brockenbrough, General Freight Agent of the lines west of the Ohio river, has resigned. O. A. Constans, division freight agent at Cleveland, Ohio, succeeds Mr. Brockenbrough, with office at Pittsburg, Pa.

Illinois Central.—C. C. Cameron, General Freight Agent of southern lines, has been appointed to the new office of General Freight Agent of the whole system. D. W. Longstreet, General Freight Agent at Louisville, Ky., succeeds Mr. Cameron, with office at Memphis, Tenn. William Smith, Jr., Assistant General Freight agent at Nashville, Tenn., succeeds Mr. Longstreet. W. E. Downing, Commercial Agent at Cincinnati, Ohio, succeeds Mr. Smith.

Union Pacific.—W. H. Murray has been appointed Assistant General Passenger Agent.

Wheeling & Lake Erie.—R. Kaser, chief clerk to the Freight Claim Agent, has been appointed Freight Claim Agent, with office at Pittsburg, Pa., succeeding C. W. Winslow, resigned.

Engineering and Rolling Stock Officers.

Central of New Jersey.—See Lehigh Valley.

Lehigh Valley.—A. H. Dakin, Assistant Engineer of the Central of New Jersey at Jersey City, N. J., has been appointed Terminal Engineer of the Lehigh Valley at New York City.

Isaac McKeever, roundhouse foreman at Lehighton, Pa., has been appointed Master Mechanic at Weatherly, Pa., succeeding Thomas Coyle, deceased.

Northwestern Pacific.—W. C. Edes, District Engineer of the Southern Pacific at San Francisco, has been appointed Chief Engineer, with office at San Francisco, of the Northwestern Pacific, a new company which is a consolidation of several Southern Pacific and Santa Fe lines in northern California.

Southern Pacific.—See Northwestern Pacific.

Wheeling & Lake Erie.—C. A. Steele has been appointed Assistant Engineer, with office at Canton, Ohio.

Special Officers.

Pennsylvania.—E. A. Sterling, formerly Assistant Forester in the Department of Agriculture at Washington, has been appointed to the new office of Forester of the Pennsylvania, effective March 1.

LOCOMOTIVE BUILDING.

The St. Louis & San Francisco expects to buy in the near future 45 consolidation (2-8-0) locomotives.

The Western Pacific denies being in the market for 10 locomotives, as reported in our issue of January 25.

The Great Northern expects to order 15 locomotives in addition to the 140 locomotives reported in our issue of January 4.

The Missouri & North Arkansas, as reported in our issue of January 18, has ordered five simple consolidation (2-8-0) locomotives from the Baldwin Locomotive Works, for June delivery. The specifications are as follows:

General Dimensions.

Type of locomotive	Consolidation
Weight, total	182,000 lbs.
Weight on drivers	164,000 "
Diameter of drivers	56 in.
Cylinders	22 in. x 28 in.
Type of boiler	Straight
Boiler, working steam pressure	180 lbs.
" number of tubes	344
" material of tubes	Spang-Chalfant charcoal iron
" diameter of tubes	2 in.
" length of tubes	14 ft. 6 in.
Firebox, length	121 "
" width	41⅝ "
" grate area	34.9 sq. ft.
Heating surface, total	2,792 "
Tank capacity	6,000 gals.
Coal capacity	14 tons.

Special Equipment.

Air brakes	Westinghouse
Couplers	Climax
Headlights	U. S.
Injector	Monitor
Sanding devices	Leach
Tires (driving wheels)	Midvale
Other specialties	Walschaert's valve gear and Richardson's balanced slide valve.

CAR BUILDING.

The Erie has ordered three postal cars.

The Chicago & North-Western has ordered 8,000 freight cars.

The West Jersey & Seashore has ordered 21 electric passenger cars.

The Nashville, Chattanooga & St. Louis is reported as in the market for 500 cars.

The Norfolk & Western will build 1,000 gondola cars at its Roanoke, Va., shops.

The Chesapeake & Ohio has ordered 4,000 steel cars from the Pressed Steel Car Co.

The Seaboard Air Line is reported to be in the market for 1,500 box cars and 1,000 coal cars.

The Chicago, Burlington & Quincy is asking prices on 4,000 box cars and 2,000 steel gondolas.

The Missouri Pacific has ordered 1,000 additional cars from the American Car & Foundry Co.

The Colorado & Southern, it is reported, has ordered 600 ore cars from the American Car & Foundry Co.

The Mexican National Packing Company, 1133 Broadway, New York, is about to order 50 refrigerator cars.

The Valley Lumber Company is reported to have ordered 15 logging cars from the Beaumont Iron Works.

The Interoceanic of Mexico has ordered some flat cars and passenger coaches from the Mexican Car & Foundry Co.

The Duluth, South Shore & Atlantic has ordered 50 rock cars of 80,000 lbs. capacity from the American Car & Foundry Co.

Fox Bros. & Co., 126 Lafayette place, New York, have secured an order for six passenger coaches for a Cuban plantation railroad.

Fox Bros. & Co., 126 Lafayette place, New York, are in the market for 150 cane cars and 60 fruit cars for Cuban plantation railroads.

The Foreman-Blades Lumber Company, Elizabeth, N. C., has ordered six logging cars from the Norport Car & Locomotive Works, Norfolk, Va.

The St. Louis & San Francisco expects to buy in the near future 3,000 box cars, 1,000 stock cars, 1,000 coal cars, 500 flat cars, 88 passenger cars and two steam motor cars.

The St. Louis Refrigerator Car Co., St. Louis, Mo., as reported in our issue of January 18, has ordered 200 steel underframe refrigerator cars of 80,000 lbs. capacity from the American Car & Foundry Co., for April, 1908, delivery.

The Louisiana & Arkansas denies having ordered 503 freight cars from Barney & Smith, but has ordered three passengers cars from Barney & Smith; also has asked bids on 500 box cars, and will probably shortly ask bids on 100 coal cars.

The General Chemical Company has ordered 25 steel underframe tank cars of 6,600 gallons capacity from the Bettendorf Axle Company for March delivery. These cars will be 31 ft. long, 9 ft. wide and 12 ft. 6 in. high, over all. The special equipment includes:

Bolsters	Bettendorf
Brake-beams	Monarch
Brake-shoes	Walsh
Brasses	Camel
Couplers	Climax
Draft rigging	Miner
Dust guards	Harrison
Trucks	Bettendorf

The Mineral Point Zinc Company, Chicago, has ordered 25 steel tank cars of 80,000 lbs. capacity from the Bettendorf Axle Company for March delivery. These cars will be 31 ft. long and 9 ft. wide, over all. The special equipment includes:

Bolsters	Bettendorf
Brake-beams	Monarch
Brake-shoes	Walsh
Brakes	Westinghouse
Brasses	Camel
Couplers	Climax
Draft rigging	Miner
Dust guards	Harrison
Trucks	Bettendorf

The Kingan Refrigerator Line, Indianapolis, Ind., has ordered 55 refrigerator cars of 60,000 lbs. capacity from the American Car & Foundry Co. These cars will be 36 ft. long and 8 ft. 11 in. wide over all, and 7 ft. 2½ in. high between sill and plate. The special equipment is as follows:

Bolsters	Common Sense
Brake-beams	Simplex
Brake-shoes	American Brake-Shoe & Foundry Co.
Brakes	Westinghouse
Brasses	Solid
Couplers	Gould
Draft rigging	Cardwell
Journal boxes	National Malleable Castings Co.
Roofs	Torsion proof
Springs	Pittsburg Spring & Steel Co.

The Chicago & Milwaukee Electric, as reported in our issue of January 25, has ordered 20 motor cars from the Jewett Car Co., for June to September delivery. These cars will weigh 77,000 lbs., and will measure 52 ft. 3 in. long, 8 ft. 10 in. wide and 13 ft. 1¾ in. high, over all. The special equipment is as follows:

Brake-beams	Baldwin
Brakes	Peacock hand and Westinghouse
Brasses	Ajax
Couplers	Van Dorn
Curtain fixtures	Forsyth
Curtain material	Pantasote
Door fastenings	Stearns
Dust guards	Symington
Heating system	Peter Smith
Journal boxes	Symington
Paint	Pullman new color
Springs	Pittsburg Spring & Steel Co.
Trucks	Baldwin

The Missouri & North Arkansas, as reported in our issue of January 18, has ordered two first class coaches from the American Car & Foundry Co., for April delivery. These cars will be 72 ft. 8¼ in. long, 10 ft. ¼ in. wide and 14 ft. 7 in. high, over all. The special equipment is as follows:

Bolsters	Commonwealth
Brake-beams	National-Hollow
Brake-shoes	Christie
Brakes	Westinghouse
Brasses	Eureka Brass Co.'s
Couplers	Tower
Curtain fixtures	Curtain Supply Co.
Curtain material	Pantasote
Dust guards	Harrison
Heating system	Safety Car Heating & Lighting Co.
Journal boxes	McCord
Light	Pintsch gas
Vestibules	Pullman

The Intercolonial, as reported in our issue of January 11, is building at its Moncton shops the motive power parts of three motor cars, the car bodies of which are being built by Rhodes, Curry & Co. These cars will seat 52 persons, and will also have baggage compartments. They will weigh about 115,000 lbs. and will measure 65 ft. 1⅜ in. long, and 7 ft. 3¾ in. high, inside measurements, and 66 ft. long and 8 ft. 11⅜ in. wide, over all. Bodies and underframes will be of wood. The special equipment includes:

Bolsters	Steel plate
Brake-beams	Simplex
Brake-shoes	Christy
Brakes	Westinghouse
Curtain fixtures	Pantasote
Curtain material	Pantasote
Heating system	Safety Car Heating & Lighting Co.
Light	Safety Car Heating & Lighting Co.
Platforms	Standard Coupler Co.
Vestibules	Pullman

The Nashville, Chattanooga & St. Louis, as reported in our issue of January 25, will build, at its Nashville shops, 25 beer cars of 60,000 lbs. capacity. These cars will weigh 40,000 lbs., and will measure 36 ft. long, 8 ft. 6 in. wide and 8 ft. high, inside measurements, and 36 ft. 8⅝ in. long, 9 ft. 11¾ in. wide and 13 ft. 11½ in. high, over all. Bodies and underframes will be of wood. The special equipment includes:

Axles	Iron
Bolsters	Simplex
Brake-beams	Simplex
Brakes	Westinghouse
Brasses	N., C. & St. L.
Couplers	Tower
Door fastenings	N., C. & St. L.
Doors	N., C. & St. L.
Draft rigging	Thornburg
Dust guards	Wooden
Journal boxes	Cast-iron
Paint	Long's, Louisville
Roofs	Winslow
Springs	Railway Steel-Spring Co.
Trucks	Arch Bar
Wheels	Louisville Car Wheel Co.

RAILROAD STRUCTURES.

BROOKLYN, N. Y.—The Brooklyn Rapid Transit Company announces that the capacity of its power plant at Kent and Division avenues is to be doubled. Contracts for additions to the power house, which is to be ten stories high, have been let, and work is to be started at once. The cost of the improvements will be about $5,500,000.

CALGARY, ALB.—Plans for a new station and office building for the Canadian Pacific are being made. Estimated cost $200,000.

DAVENPORT, IOWA.—Surveys are being made by the Chicago, Milwaukee & St. Paul of a site for a new freight house; also in connection with the proposed union passenger station.

HALIFAX, N. S.—Bids are wanted January 31 by D. Pottinger, General Manager of the Intercolonial at Moncton, N. B., for putting up car shops and a planing mill at Halifax.

KANSAS CITY, KAN.—The Edgewater Terminal Railway Company in return for franchises to be granted by this city proposes to build a passenger station to cost $35,000.

MILWAUKEE, WIS.—The Milwaukee Light, Heat & Traction Company is planning to put up car shops, in which to build its cars.

MINOT, S. DAK.—Plans, it is said, have been made by the Minneapolis, St. Paul & Sault Ste. Marie for a stone and brick passenger station, to cost with other improvements $100,000.

MONROE, N. C.—Plans are being made by the Seaboard Air Line for a freight house and for other improvements to cost $60,000.

MONTREAL, QUE.—The Grand Trunk, it is reported, has decided to improve its main line between this place and Toronto at a cost of $10,000,000. The work will include a bridge over an arm of Lake Ontario.

The Grand Trunk and the Grand Trunk Pacific, it is said, are back of a project to put up a new hotel here to cost $3,000,000.

NEEDLES, CAL.—Contracts have been given by the Atchison, Topeka & Santa Fe (Coast Lines) for a new passenger station at a cost of about $175,000 to replace the one burned last summer.

OTTAWA, ONT.—The Grand Trunk, it is said, has obtained from the Canadian Government a lease of the canal reserve in Ottawa for 999 years. The ground will be used for a new passenger station to cost $250,000.

READING, PA.—According to local reports, the Philadelphia & Reading has given contracts to Enos L. Seeds for putting up a steel freight house 30 ft. x 194 ft., and a two-story brick office building 20 ft. x 30 ft.

SACKVILLE, N. B.—Bids are wanted February 4 by D. Pottinger, General Manager of the Intercolonial at Moncton, N. B., for putting up a passenger station here.

SCRANTON, PA.—It is announced that the Delaware, Lackawanna & Western will build locomotive shops here on the site of the Lackawanna Iron & Steel Company's north mills. The cost of the improvements will be about $2,000,000.

SEATTLE, WASH.—Plans are being made for freight terminal facilities for the Harriman lines on ground 600 to 800 ft. wide and about a mile long which it already owns at Duwanisch avenue. The work includes new tracks, round houses and freight sheds; when completed this will be one of the largest terminals on the Pacific coast.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ATLANTA, BIRMINGHAM & ATLANTIC.—This company is to open its line between La Grange, Ga., and Brunswick for regular freight and passenger service about March 1, and will inaugurate a through passenger service between Brunswick and Atlanta over the Atlanta & West Point.

BOSTON SUBWAYS.—Application has been made for permission to build a subway and tunnel from Park street under the Charles river embankment back of Beacon street to the junction of Beacon street, Commonwealth avenue and Brookline avenue.

BUFFALO & SUSQUEHANNA.—Plans for rebuilding portions of this road from Jeneau south toward Pittsburg and for building new yards have been made. Bids for the work may shortly be asked.

CANADIAN PACIFIC.—According to a statement of Second Vice-President William Whyte, this company has plans for building 350 miles of new line in the west during 1907 at a cost of about $6,000,000. This includes completion of the line from Winnipeg via Saskatoon to Edmonton, a great part of which is already completed. The Pheasant Hill branch, which is now built about 17 miles west of Strassburg, is to be extended to connect with the Edmonton line, and a 50-mile extension is also to be built from Moose Jaw northwest towards the Saskatchewan river. In addition to this work, the company expects to finish about 300 miles of double-tracking between Fort Williams and Winnipeg during the year.

CHICAGO, BURLINGTON & QUINCY.—Maps have been filed by this company for an extension of the Big Horn Railroad from Worland, Wyo., south to Thermopolis, thence along the Big Horn river to a point where the line will turn west toward Salt Lake City, which, it is said, will be its ultimate destination.

CHICAGO, LAKE SHORE & SOUTH BEND (ELECTRIC).—An officer writes that contracts for the entire construction and equipment of this proposed electric line from South Bend, Ind., to Kensington, which is within the city limits of Chicago, have been let. Ninety per cent. of the right of way has been bought. This is to be 50 ft. wide for the first 15 miles, and beyond that at least 66 ft. wide. In some places it will be 120 ft. wide. Work has already been begun on two bridges over the Calumet river. Track has been laid for 10 miles out of South Bend, Ind. Grading work is under way west of New Carlyle, Ind., and tracklaying will be started within the next two months from Gary, Ind., west to the terminal of the road. The company has bought five acres of land in Chicago as a site for terminals and has also secured a site at Michigan City for its power house. The South Bend Construction Company are the contractors. J. B. Hanna, President, South Bend, Indiana.

CINCINNATI & BIRMINGHAM AIR LINE.—Application will be made for a charter by this company to build a line from Paintsville, Ky., where connection is to be made with the Norfolk & Western and the Chesapeake & Ohio to Jeff, Ala., approximately 420 miles. J. H. Connors, formerly of the projected Nashville & Huntsville, is interested.

FREEO VALLEY.—An officer writes that contracts have been let to S. R. Neu, of Princeton, Ark., for extending this road from mile post 22 to mile post 26.

FRONT ROYAL, RAPPAHANNOCK & TIDEWATER.—Preliminary surveys have been made for this proposed line from Front Royal, Va., to Griglersville, 50 miles. Hugh E. Naylor, Secretary, Front Royal.

GRAND TRUNK PACIFIC.—Hon. H. R. Emmerson reports that on the section of the National Transcontinental between Winnipeg and Superior Junction the excavation will amount to 11,233,247 cu. yds. of earth and 3,696,336 cu. yds. of rock. Of this 282,009 cu. yds. of earth and 179,920 cu. yds. of rock have been completed. J. D. McArthur, contractor.

On the section between La Tuque and Quebec there are 6,303,682 cu. yds. of earth and 1,169,150 cu. yds. of rock. Work to date amounts to 664,995 cu. yds. of earth and 322,367 cu. yds. of rock. Contracts call for the completion of these sections by Sept. 1, 1907.

GRAY'S HARBOR & PUGET SOUND.—An officer writes that this company has been incorporated in Washington to build a line from Aberdeen and Hoquiam, Wash., west to Centralia, 75 miles. Most

of the surveys have been made, and construction is under way on part of the line. The office of the company is at Aberdeen. The officers are: A. J. West, President; J. B. Bridges, Counsel; W. J. Patterson, Treasurer and General Manager; J. F. Richards, Purchasing Agent and Assistant Auditor, all of Arbedeen, and J. M. Clapp, Chief Engineer and Auditor, of Seattle.

INTERNATIONAL OF NEW BRUNSWICK.—This company has completed 33 miles out of Campbellton, N. B., Thos. Malcolm, contractor. The road is to be extended to St. Leonards, on the St. John river, 110 miles, from Campbellton. Additional contracts for 60 miles are to be let early in March.

KANSAS CITY & SPRINGFIELD SOUTHERN.—An officer writes that surveys have been made for this road from Springfield, Mo., to Richards, 95 miles, and from Sylvania to Stockton, 18 miles. Office at 2975 Michigan avenue, Chicago.

KENTUCKY & TENNESSEE.—Contracts have been given by this company to C. B. Donaghy, for extending its road from Yamacraw, Ky., six miles. Surveys are being made for an extension from Yamacraw to Bellfam, 12 miles.

LAKE ERIE & PITTSBURG.—See Lake Shore & Michigan Southern.

LAKE SHORE & MICHIGAN SOUTHERN.—An officer writes that contracts have been let to the Carter Construction Co. to extend the Lake Erie & Pittsburg from Mill Creek Junction, near Cleveland, Ohio, to Kent, 26 miles. The line is projected beyond that place to a point not yet decided on. Samuel Rockwell, Chief Engineer, Cleveland, Ohio.

MASCOUTAH & BELLEVILLE (ELECTRIC).—This company has projected a line from Mascoutah, Ill., to Belleville, 11 miles. Peter W. Lill, Secretary, Mascoutah, Ill.

MISSOURI & NORTH ARKANSAS.—Contracts have been given by this company, formerly the St. Louis & North Arkansas, to Burke & Josephs, of Cape Girardeau, Mo., for building an extension from Leslie, Ark., southeast to Pangburn, 75 miles. Surveys are being made from Pangburn to the Mississippi river, about 100 miles, and from Seligman, Mo., northwest to Joplin, 60 miles.

MOBILE & WESTERN.—An extension of this road is projected from Mission Church, Ala., to which point the road was built last year, west to the Mississippi river.

MOREHEAD & NORTH FORK.—Contracts let to the Snyder Construction Co., of Morehead, and the Rinehart & Dennis Co., of Washington, S. C., for building this line from Morehead, Ky., to Paragon, 10 miles. E. W. Hess, Clearfield, Pa., is interested.

NEW RIVER, HOLSTON & WESTERN.—Contracts have been given to the Sale Construction Co., of Narrows, Va., for extending this road from Boxley, Va., to Day, two miles.

NEW YORK CITY ROADS.—Plans for a four-track subway loop by the city of New York at a cost of $5,245,000 to connect the Brooklyn and Williamsburg Bridges, has been approved and bids will be asked shortly. The work will take about three years.

NORFOLK & WESTERN.—Contracts are reported let for six tunnels aggregating 6,100 ft. on the West Virginia division, to cost about $3,000,000. The work, which is to be completed within three years, will reduce the curves and shorten the distance about 15 miles.

OPELOUSAS, GULF & NORTHEASTERN.—An officer writes that contracts have been let to Myrick & Andrews, of Opelousas, La., for extending this road from Melville, La., to Crowley, 58 miles. C. C. Genung, Chief Engineer, Opelousas, La.

PONTIAC CENTRAL.—Application will be made to the Quebec Legislature by Ryan & Bickerdyke, attorneys, Montreal, to incorporate this company to build from Bryson, Que., to a point on James Bay, Ontario.

RALEIGH & WESTERN.—An officer writes that surveys are being made for an extension from Cumnock, N. C., to Greensboro, 50 miles.

SOUTH & WESTERN.—An officer writes that this road is now under construction from Fink, Va., south to Johnson City, Tenn., 82 miles, and from Altapass, N. C., to which point it was extended last year south to Bostic, 62 miles.

STEUBEN TRACTION COMPANY.—The New York State Board of Railroad Commissioners has given authority to this company to issue a mortgage for $500,000 and increase its capital stock from $370,000 to $630,000. The company, which is a consolidation of the street railroads in Hornellsville, N. Y., and Canisteo, proposees to build south about 15 miles to Jasper.

TECUMSEH-NORMAN TRACTION.—An officer writes that surveys are now being made, and when these are completed contracts will be let for building this electric line from Tecumseh, Okla., west via Brown, Waco and Denver to Norman, about 40 miles. W. F. Powell, Tecumseh, is President. (Nov. 30, p. 159.)

TEMISKAMING & NORTHERN ONTARIO.—An officer writes that construction work is now under way from McDougalls Chute, Ont., north seven miles. Contracts have been let for branches from Cobalt to Kerr Lake, four miles; from Engleheart to Charlton, eight miles, and from Haileyburg to Haileyburg wharf, one mile. A. R. McDonnell, of New Liskeard, has the contract for work on the main line. Surveys are being made for a 45-mile extension from seven miles north of McDougall to a connection with the National Trans-Continental (Grand Trunk Pacific).

WINNIPEG & NORTHWESTERN.—Application is to be made by A. T. Drummond, of Winnipeg, at the present session of Parliament at Ottawa, for a charter for this company, which proposes to build a line from Winnipeg north between Lake Manitoba and Winnipeg, then west by way of Fort La Corne and the north side of Saskatchewan river to Lopstick river. Branches are also to be built to connect with Battleford, Lac la Biche, Edmonton and Athabasca Landing.

RAILROAD CORPORATION NEWS.

ALABAMA CENTRAL.—Bradford Dunham has been appointed Receiver on application of the General Manager. The company owns nine miles of road from Booth's Station, Ala., to Autaugaville.

ATCHISON, TOPEKA & SANTA FE.—Gross earnings for the six months ended December 31, 1906, were $45,576,512, an increase of $5,708,070; net earnings, $17,781,010, an increase of $2,352,491. The average mileage operated increased from 9,130 to 9,237.

ATLANTA, BIRMINGHAM & ATLANTIC.—Clark, Dodge & Co., New York, and the Trust Company of America are offering at a price to net 6.15 per cent. $2,000,000 first collateral trust four-year 5 per cent. coupon joint notes of May 1, 1906, of the Atlantic & Birmingham Construction Co. and the Atlanta, Birmingham & Atlantic Railroad, being part of an issue of $8,000,000. (June 8, p. 168.)

CANADIAN PACIFIC.—Gross earnings for the six months ended December 31, 1906, were $37,464,474, an increase of $6,082,497; net earnings $14,585,867, an increase of $2,398,468.

CENTRAL OF GEORGIA.—Gross earnings for the six months ended December 31, 1906, were $6,127,246, an increase of $247,157. The operating ratio rose from 69 per cent. to 76 per cent., leaving net earnings of $1,473,999, a decrease of $376,645.

CHICAGO, MILWAUKEE & ST. PAUL.—The chairman of the board is quoted as follows concerning the Pacific extension of this road:

"The line will be 150 miles shorter from Chicago to Seattle than the Northern Pacific, and about 80 miles shorter than the Great Northern. Over the mountains the grades will be from 1⅞ per cent. to 1½ per cent. compensated. The Northern Pacific grades are in all cases 2½ per cent., any many of them are not compensated, and therefore average as high as 2⅝ per cent. Aside from mountain grades, the St. Paul road has a much lower grade than the Northern Pacific, and the mountain grades are so bunched that they will not impede traffic. The extension is compelled to run along the Northern Pacific for a considerable distance, and to cross the Northern Pacific several times by reason of the physical conditions. This, however, does not apply to much territory which produces a large business, and therefore the competition will not be severe. The estimated cost of the extension will be $40,000 a mile for the main line, which includes equipment, and $30,000 a mile for branches. This contemplates a strictly first-class road in all respects. It is expected to have the road in operation to Butte, Mont., by the end of 1907, and the entire line in about three years."

CHICAGO, ROCK ISLAND & PACIFIC.—Gross earnings for the six months ended December 31, 1906, were $29,957,274, an increase of $2,946,496; net earnings, $10,041,879, an increase of $1,475,806.

CHICAGO, SOUTH BEND & NORTHERN INDIANA (ELECTRIC).—The Northern Indiana, which operates 77 miles of road, consisting of street railways in South Bend, Ind., Mishawaka, Elkhart, Goshen, La Porte and Michigan City, and interurban lines between these points, has been sold for $4,000,000 to the Dieterich-Murdock syndicate. The Chicago, South Bend & Northern Indiana has been incorporated with $7,000,000 capital to take over the property, and it is intended to at once begin an extension from South Bend via Michigan City to Chicago.

CORNWALL & LEBANON.—A dividend of 4 per cent. on the $8,000,000 capital stock has been declared payable January 31. A semi-annual dividend of 3 per cent. was paid July 31, 1906, the annual rate having been 6 per cent. since 1901.

GREAT NORTHERN.—The Attorney-General of Minnesota has brought suit to have the charter of the St. Paul, Minneapolis & Manitoba forfeited. This road runs from St. Paul, Minn., to Lowell, Wash., 1,790 miles, and forms part of the main line of the Great Northern, which leases it for 999 years from 1890. The Great Northern has assumed the funded debt of the St. P., M. & M., and the greater part of the capital stock of the last named company has been exchanged for Great Northern stock.

Green Bay & Western.—The reorganization plan proposed by the holders of the debenture "B" income bonds last October has been withdrawn, and the bonds deposited under its provisions have been returned to the holders. The plan provided for the purchase of the capital stock by the debenture holders, the reorganization of the road under the name Green Bay & St. Paul, an issue of new first mortgage bonds of the new company, and an extension of the line to St. Paul. (Oct. 26, p. 116.)

Hocking Valley.—Gross earnings for the six months ended December 31, 1906, were $3,504,042, an incerase of $82,222; net earnings $1,198,037, a decrease of $125,761.

Hudson & Manhattan.—The enterprises planned by this company include a tunnel from Jersey City to Christopher street, New York, already built; a tunnel from Jersey City to Cortlandt street, New York, to be finished in 1908; a subway line connecting the Manhattan terminals of these tunnels with Herald Square; an office building at Herald Square, and a terminal and office building, which, it is reported, will be the largest skyscraper in the world at Cortlandt, Church and Dey streets, New York, for which the steel caissons are now being sunk. The Hudson & Manhattan Railway, which is the holding company controlling the various subsidiary companies incorporated to carry out these different projects, has sold $40,000,000 4½ per cent., 50-year, convertible bonds to a syndicate of the bankers who control the property, principally represented by Harvey Fisk & Sons. The whole cost of the enterprise has been estimated at $60,000,000. The work is being done by the Hudson Companies, which is the construction company for the Hudson & Manhattan. There has recently been a report that a controlling interest in the Hudson & Manhattan has been acquired by the Interborough-Metropolitan Company, but this is not confirmed, although several directrs of the Hudson & Manhattan are also directors of the Interborough-Metropolitan. It is announced that the line from Fourteenth street and Sixth avenue to Christopher street and under the Hudson river to Jersey City will be put in operation this September.

Interstate Railways Company.—This company, which controls, through subsidiary companies, 515 miles of electric road in New Jersey and Pennsylvania, is to begin on February 1 the operation of the Philadelphia, Bristol & Trenton, the control of which it acquired last September. The P., B. & T. owns 21 miles of road from Torresdale, Pa., to Morrisville. Heretofore it has reached Trenton, N. J., by trackage rights with the Pennsylvania & New Jersey Traction Company, but it is now expected that the line will be extended from Morrisville to Trenton.

Kansas City Southern.—Gross earnings for the six months ended December 31, 1906, were $4,389,773, an increase of $776,593; operating expenses decreased $28,799, leaving net earnings of $1,732,463, an increase of $805,392.

Lake Shore & Michigan Southern.—See New York Central Lines.

Lehigh Valley.—Gross earnings for the six months ended December 31, 1906, were $18,374,244, an increase of $801,997; net earnings $7,617,881, an increase of $390,205.

Maine Steamship Co.—See New York, New Haven & Hartford.

Michigan Central.—See New York Central Lines.

Metropolitan West Side Elevated (Chicago).—A quarterly dividend of three-quarters of 1 per cent. on the $8,708,000 outstanding 5 per cent. non-cumulative preferred stock has been declared payable March 30 to holders of record on March 21. This is the first dividend since February, 1903, when 1½ per cent. was paid.

New York Central & Hudson River.—See New York Central Lines.

New York Central Lines.—J. P. Morgan & Co. have sold $50,000,000 three-year 5 per cent. notes recently bought from three New York Central lines. Of this amount, $25,000,000 were New York Central & Hudson River notes, the proceeds to be used, it is understood, to pay for electrification in and near New York City; $15,000,000 Lake Shore & Michigan Southern, for four-tracking and other improvements; and $10,000,000 Michigan Central, probably to be used for the Detroit tunnel.

New York, New Haven & Hartford.—The report that this company had obtained control of the Maine Steamship Company, which operates a line of steamboats between New York and Portland, Me., has been confirmed. (Jan. 25, p. 130.)

Northern Indiana (Electric).—See Chicago, South Bend & Northern Indiana.

Northwestern Pacific.—A meeting of the shareholders has been called for March 12 to vote on an issue of $35,000,000 mortgage bonds, part of which are to be used to retire bonds of constituent companies. The Northwestern Pacific, which was recently incorporated, is a consolidation of several Southern Pacific and Atchison lines in northern California, aggregating about 500 miles. Of the nine directors, five represent the Southern Pacific and four the Atchison. Each of the controlling companies is to be in control in alternate years. (Jan. 18, p. 96.)

Panama Railroad.—The annual report for the year ended June 30, 1906, shows gross earnings of $2,570,828, an increase of $311,990. Operating expenses, however, increased $552,944, particularly because of the greatly increased cost of conducting transportation due to the interference with traffic when strict quarantine measures were enforced in the latter part of 1905, and also because of the heavier equipment used and the increased cost of labor and supplies. The net earnings were $838,939, a decrease of $240,953. Concerning the condition of the road at the close of the preceding year, the report quotes from a recent letter from Vice-President John F. Stevens, part of which follows:

"The Panama Railroad Company had practically nothing more than a right-of-way with a fair roadbed which had, however, already proven unequal to the heavy traffic it was called upon to bear. Its rolling stock was limited in quantity, small in capacity, and of antiquated type and entirely unsuited to the demands put upon it. It had not the requisite sidings either for handling through or local business, and those that were in existence were at the end of their lives and had to be rebuilt. From Colon to Panama there was not a single station building which was adequate to the requirements of the service, and not to exceed two telegraph operators between terminals, with no telegraph lines over which a train order could be sent with any certainty that it would reach destination inside of twenty-four hours. Its ocean terminals were neither commodious, well arranged nor had they been maintained in a safe condition. The personnel of the road, while in the main consisting of well-meaning parties, had grown up under conditions which, instead of inducing development and progress, had practically kept it at a standstill for years. The throwing upon the road of the immense amount of back business which resulted from the occupancy of the Zone by the United States, and the commencement of the work of preparation for building the Panama Canal made the railroad proposition an almost impossible and disheartening one from the start, it being necessary in every department, without one single exception, to build from the ground up to get the property in shape, while handling not only the current affairs but disposing of the vast amount of business which had been delayed owing to various causes for months. The work of reorganization and reconstruction and the carrying on of the current business, as well as catching up the past, has been conducted during the past fiscal year. The ocean terminals have been more than trebled and terminal yards, with all needed accessories, have been constructed, so that we can now point to the fact that business in the port of Colon over the Company's docks is handled at a cost, considering the local labor conditions, which is unequalled and at a rate of speed that is not exceeded by any port in the world. In fact, the handling of cargo across the docks at Colon is being done quicker and with less trouble than cargoes are handled over the docks in New York City."

Philadelphia, Bristol & Trenton.—See Interstate Railways Company.

Pittsburg, Fort Wayne & Chicago.—According to press despatches, a mortgage for $12,500,000 has been filed in Indiana, the proceeds of the bonds to be used for improvements. The road is operated by the Pennsylvania Company.

Rochester, Syracuse & Eastern (Electric).—The New York State Railroad Commission has authorized this company to issue $3,000,000 first mortgage bonds of 1945, being part of an authorized issue of $7,500,000, of which $2,000,000 are now outstanding. The company operates a duble-track road from Rochester, N. Y., to Lyons, 37 miles, and work is under way on an extension to Port Byron, 58 miles; it is eventually to be extended to Syracuse.

St. Louis & San Francisco.—Gross earnings for the six months ended December 31, 1906, were $24,391,262, an increase of $2,779,855; net earnings, $8,561,365, an increase of $1,161,477.

St. Paul, Minneapolis & Manitoba.—See Great Northern.

Santa Fe, Liberal & Englewood.—E. D. Shepard & Co., New York, are offering a block of the $8,000,000 authorized first mortgage 5 per cent. gold bonds of 1936. The issue is secured by a mortgage covering 321 miles of road under construction from a connection with the Colorado & Southern at Des Moines, N. Mex., to connections with the Atchison, Topeka & Santa Fe at Englewood, Kan., and Woodward, Okla., and will also cover, it is said, 16 locomotives and 2,398 cars. The company has leased the Santa Fe, Raton & Des Moines, now under construction, and the Santa Fe, Raton & Eastern, which is in operation, for 99 years. (Jan. 18, p. 96.)

Seaboard Air Line.—This company is to extend to May 1, 1911, the $4,665,000 5 per cent. guaranteed collateral trust and general lien mortgage bonds due March 1, 1907. The holders of these bonds may exchange them for their face value in extended bonds and $20 cash additional per bond. The President of the Continental Trust Co., Baltimore, is the manager of a syndicate which has arranged to buy any part of this issue which is not extended.